Gliding Safety

Derek Piggott

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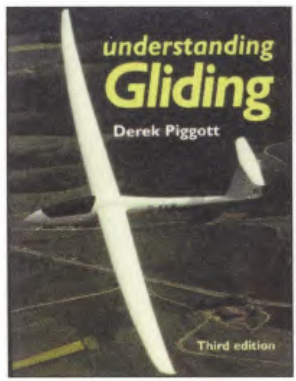

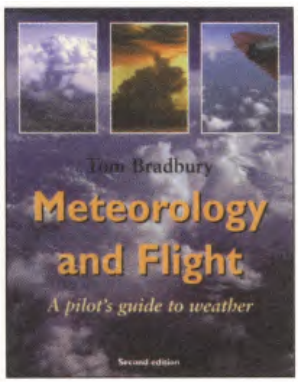

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GLIDING SAFETY

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Derek Piggott

To Wally
With thanks for getting me to Lasham
Derek Piggott

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Foreword

In this new edition, you will see that I welcome the new British Gliding Association thinking on circuit procedure. This introduces the idea of a diagonal leg cutting the corner from the down wind to the base leg to keep the landing area within range and in view all the time.

Of course, the use of a diagonal leg calls for flexibility. You need to understand when to cut the corner and by how much and to learn to make adjustments to both the diagonal and base legs. The aim is to encourage the pilot to be more flexible and to discourage the instructor from criticising the shape of the circuit pattern if it results in a good approach, both points I have been emphasising for many years.

Derek Piggott
June 1997

Section 1

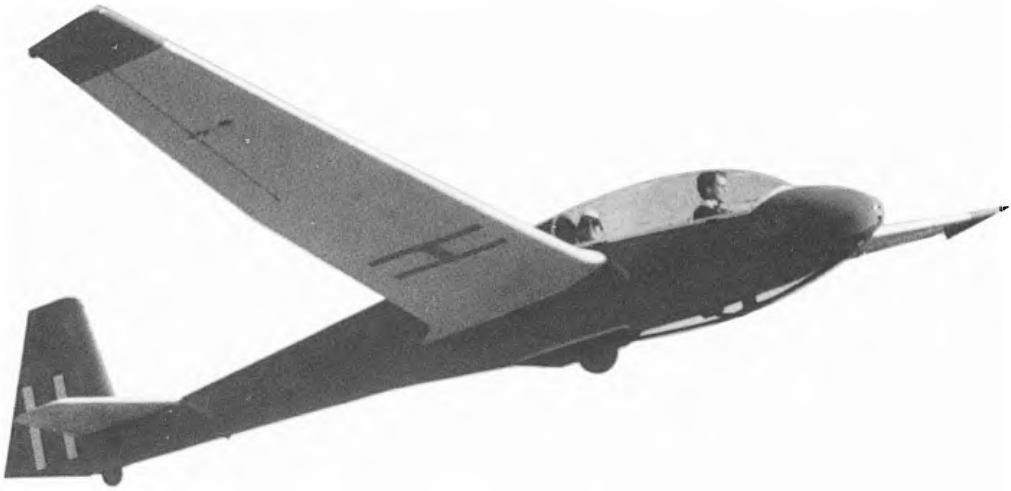
Avoiding gliding accidents

Gliding safety depends on good training and on instructors encouraging novices to develop safety-conscious habits. Most accidents occur because the pilot is unaware of, or chooses to ignore, possible hazards.

Safety must be everyone's concern – the majority of accidents could be avoided if every pilot is aware of the common hazards. Reading or hearing of other pilots' experiences emphasises how easy it is for even seasoned pilots to make mistakes.

Instructors and senior pilots have a big responsibility to pass on their expertise and knowledge and to look out for poor airmanship and flying techniques in others which could lead to mishaps in the future.

In Section 1, I have chosen various gliding areas which involve special hazards for the unwary, and have suggested how to prevent accidents by being conscious of potentially difficult situations.



How glider accidents happen

Considering that so many gliders are flown across country on every possible soaring day, the accident rate for gliding is extremely low. However, it must always be remembered that, like the sea, the air is an environment which is potentially dangerous to the unwary. There are, of course, always a number of minor incidents and accidents during training. The result of every accident, however minor, is a rise in the cost of insurance, the loss of the aircraft while it is replaced or repaired and, sometimes, injuries to the pilot and other people involved.

Most glider pilots have never experienced anything more hazardous than a bad landing, so reading and talking about other people's mistakes is almost the only way of becoming aware of the kind of situations which lead to broken gliders. Few pilots realise how much even minor damage can cost to repair. Just slipping and dropping a wing while loading it into the trailer will cause hundreds of pounds' worth of damage, and although most gliders are insured, every accident eventually results in higher premiums and higher costs for gliding enthusiasts.

It is quite rare to have an accident directly caused by some kind of technical failure. The main cause is almost always something to do with the pilot's flying skills or judgements. 99% of all gliding accidents happen when the aircraft hits something. A few pilots manage to stall and spin in; some fly into the ground during their final turn; many make such bad landings that they damage their glider; and, finally, far too many run into other gliders or obstructions during take-offs and landings. This indicates that instruction is failing to get across the vital aspects which could reduce the risk of accidents.

Are you fit to fly?

When an emergency situation arises the pilot needs all his wits about him. A surprising number of accidents and incidents happen because pilots are in some way not 100% fit on the day in question. Obviously, if you have a heavy cold, a headache, are suffering from lack of sleep or are jet lagged, you should not be flying. But the decision about whether or not to fly is left to you, the pilot. You alone have to make that judgement. It is best to make a firm rule not to fly if you are feeling unwell or unenthusiastic. If you have spent a long day on the airfield, it will be difficult to refuse your turn to fly, even if you are tired. However, if you are going to fly solo, refusing is the only sensible thing to do.

Flying demands all your concentration and it is not wise to risk flying if you have business worries or some other mental stress on your mind. Even a violent argument will leave you mentally high and quite unfit to fly.

You can also become unfit in the air through lack of food and drink. Both these factors can cause lack of concentration and apathy. In warm weather,

dehydration is a serious problem, and sufficient liquid must be taken during the flight even if this has its disadvantages afterwards!

Keeping in practice

It is probably true to say that the first few solo flights are the safest that a student pilot ever makes. This is because he has recently practised safety procedures for almost every conceivable emergency, and they are therefore fresh in his mind. Also, the pilot will be in very good flying form and his instructor will have made sure that he has not been getting into bad habits. It is important to try and keep in practice in order to reinforce all the things which have been learned during the pre-solo training.

Most gliding clubs have a system of re-checking pilots during the first few hours of solo flying, but then pilots are left very much to their own devices to improve their soaring techniques. They may go several years without a cable break on the winch launching, and so they will scarcely give the possibility any thought. An annual briefing on cable break procedures and other emergencies would be very valuable for everyone who flies gliders, and particularly those who stop flying for long periods over the winter months and so get badly out of practice.

Many pilots select the days on which they fly so that the weather is near ideal and not too windy. It is easy to forget exactly how much allowance should be made for the wind and other factors on a rough day. Pilots who have only flown in light winds will be dangerously incompetent in rough weather, particularly if they are also out of current flying practice. If they do attempt to fly on a windy day, then a check flight should be made to ensure that they remember the hazards and how to avoid them.

When pilots from a big, flat site visit a hill site, they are at risk and often make absolute fools of themselves unless they get a very thorough briefing and listen to what local pilots and instructors have to say. It is always wise to have a dual flight before flying solo at an unfamiliar site. There is always something to be learned from a knowledgeable local instructor, and a flight is far more valuable than just a site briefing.

Being in practice is also important for a first flight in a new and unfamiliar type of aircraft. Always avoid doing too many new things in one flight; i.e. do not fly a new type of aircraft on an unfamiliar airfield. Try and get a dual flight on the airfield so that at least you know something about the airfield and its surrounds.

Wire launches

A large proportion of gliding accidents and incidents result from launch failures. Too many pilots seem to believe that they can cope with these failures and then are proved wrong. Most accidents happen when a cable break occurs close to the ground. Here a failure calls for immediate action if you are to level out into normal flight and so prevent a stall. Always ensure that the initial climbing angles on a winch or car launch will allow time for a safe recovery into

the glide if the cable breaks. Too many pilots allow their glider to zoom up too steeply as they leave the ground. This is always dangerous because at that moment the glider has insufficient speed to allow for safe recovery and landing. If pilots continue to do this, sooner or later they will get hurt.

Far too often with a low cable break, the pilot goes for the airbrakes when there is a mile of field ahead and no hurry whatsoever. The actual speed at the time is usually far too slow to allow for any use of the airbrakes, but there is plenty of room ahead for a safe landing.

If the failure occurs higher on the launch, again a snap decision can be fatal. Lower the nose and check the actual airspeed before doing anything else. The most common cause of serious accidents on wire launches is making a snap decision to turn off for a 360° turn without ensuring that there is enough speed. Even though the nose has been lowered well below the horizon, a glider takes time to regain speed, and any attempt to turn off immediately results in a potential stall and spin accident. The first question you ask yourself is 'can I get down straight ahead?' If the answer is no, then check the speed before starting to turn.

Reacting too slowly and taking too long to make a decision can also be hazardous. If you obviously cannot get down ahead or if you have doubts about it, then you have no alternative but to turn off, but check your speed first!

How to avoid problems with wire launches

1 Go over the launch failure procedures after any long lay-off from flying.

2 Try and think systematically about your actions in the event of a launch failure.

3 Always assess the special considerations and conditions for the day (e.g cross winds, turbulence etc.).

4 At an unfamiliar site, talk to the locals and discuss the best course of action for launch failures.

5 Before you take off, ask yourself the following questions. Is the glider ready? What about the weather conditions? Are you ready for a launch failure? Is it safe to go now?

6 Always expect and be ready for a launch failure in the first 500 feet on every launch.

Soaring

Inexperienced pilots get into difficulties when they are soaring. They often get lost because they have not kept the airfield in sight and within easy gliding range. It is important for these pilots to develop the habit of checking the position of the gliding site immediately after releasing the tow and to re-check it regularly every few circles. It is also important to be aware of the wind direction and the amount of drift, and to avoid drifting down wind whenever possible. Beginners often continue to struggle with weak lift without realising

that they are, in fact, losing height and drifting further away. If the variometer is fluctuating and reading up on one side of the circle and down a little on the other, the probability is that the glider is not climbing at all but is just drifting further down wind.

If the glider is down wind of the site, the decision to return must be taken before the glider gets to less than an angle of about 20° to the field in light winds, and 30–40° in windy weather.

Allowance must always be made for wind strength and the possibility of strong sink, since it can never be known beforehand whether there will be lift or sink on the way back. A common mistake is to try to use lift on the way back instead of gliding on through it at a sensible speed. This nearly always results in drifting further back without much gain of height and ending up in a worse situation than before.

If it begins to look doubtful that the site can be reached and the glider is down to 1,000 feet, it is time to select the best possible field within easy reach and to make a safe landing in it. If you glide back any lower, the choice of landing area becomes very limited, until finally there is no choice at all. Be decisive. If you are uncertain about whether or not you can get back with a reasonable margin of safety, make a safe landing while you can; a planned approach into a poor field is better than an out-of-wind crash into a good field!

For inexperienced pilots flying in light winds, a good general rule is to allow a maximum of 3 miles' glide per 1,000 feet with nothing for the last 1,000 feet. However, an extra allowance must be made for any head wind, and in poor visibility inexperienced pilots should make sure that they are close enough to keep the field in sight all the time.

Almost all accidents start with a simple error on the part of the pilot that leads to a chain of events, each of which makes the situation worse and an accident more and more difficult to avoid. The art of safe piloting is to learn to avoid the initial error whenever possible. But, if an error of judgement or a bad decision has been made, the vital thing is to recognise that, admit it and take immediate action to break the chain of events while a safe course of action is still possible. Forget the error or the cause of the problem and get on with correcting it and avoiding a worse situation. A similar situation occurs when soaring cross-country. Although you may get ridiculously low because of pressing on too hard, when, a few minutes later, you are back in the good conditions several thousand feet up, you must forget the wasted time and concentrate on flying normally.

Ground handling damage

Nothing is more heartbreaking than to see a beautiful glider damaged by incompetent handling on the ground. For every incident which causes damage to a glider while it is being flown, there must be many more that happen because of careless or thoughtless ground handling. Sometimes these accidents are caused by laziness, but more often they are the result of someone not realising the significance of doing things the right way. All of them are avoidable and cost time and money.

Student pilots need very thorough briefing about the hazards of ground handling in a strong wind and, since most flying is restricted to light winds, this must be reinforced whenever the conditions make extra care necessary.

Towing

The danger involved when towing the glider into a strong wind cannot be stressed too much. This is when there is the greatest risk of the glider being lifted off the ground by the first strong gust. With no one in the cockpit and the tail on the ground, most gliders will develop enough lift to leave the ground at well under 30 knots. To prevent this happening, the nose of the glider should be held down (or the tail held up) to reduce the wing incidence, as this in turn reduces the lift significantly. Usually, the weight of a person on the extreme nose will prevent the glider lifting off the ground, but to be safe it is best to put a person in the cockpit.

Anyone sitting in a glider must always be properly strapped in. If a glider was blown over with someone sitting inside it unstrapped, that person could be killed. The airbrakes should always be opened (tying them open with a harness strap, if necessary) as this reduces the lift and increases the 'lift-off' speed by several knots.

A student at Lashan Gliding Centre was badly hurt once when the glider lifted off the ground and came down on top of him as he walked by the nose. This was caused by a combination of a very strong gust and the fact that no one was keeping the nose down while the glider was being towed into wind. The wind that day had been increasing with the approach of bad weather and the instructor, who had decided that it was time to stop, was towing the glider to the hangar. In such situations, it is always worth considering whether it is safer to have another launch and fly the glider to the hangar. Flying is often safer than towing into a really strong and gusty wind. Obviously, the slower the tow is into wind, the less airflow there is over the wings, and thus the safer it is.

On a windy day, more care is usually taken, but even then a few moments' inattention, or the wrong drill, can result in the glider being blown over and written off.

When a glider is being moved around the airfield, one person should take charge of the whole operation and be responsible for the safety of the aircraft. This is normally either the pilot or the instructor. This person must brief the

helpers if they are inexperienced. He should insist that the correct wing is held, and direct the car or tractor driver so that they take a safe route which is clear of any hazard from dropping winch cables. It is his responsibility to decide whether the glider should be manned at the nose or tail, and whether someone is needed in the cockpit. In a strong wind he must refuse to move until sufficient additional crew arrive to handle the glider safely. Many accidents happen through impatience. If you cannot be sure of handling the glider safely, turn it out of the wind, hold the wing down and wait for help.

Ground handling

Wing-tips

It is generally agreed that only one wing-tip should be held while the glider is being moved about. This is because if there is a person on both wing-tips, neither may have a good grip. Furthermore, it is all too easy for both people to decide to let go at the same moment, so that no one is left holding a wing-tip.

Traditionally, it was usual to take the upwind wing-tip and to hold it slightly below the horizontal. This was because with the older gliders like the T21 or T31, the wings were very high and they could not be held securely except by keeping one wing low. However, when towing in a cross wind, the glider will tend to weathercock into wind, and the person on the upwind wing will have difficulty in pushing forward enough to prevent this happening. With a modern glider which has a lower wing and the wheel well ahead of the c.g., this weathercocking will be even more pronounced, so it is better to hold the down wind tip. (Just as with the cross wind take-off, the down wind wing should be held so that any slight pull will not help the weathercocking into wind.)

Groundhandling an ASK13

Light winds

It is a great temptation to tow a single-seater back with only the pilot on the wing-tip. This may be reasonably safe with a very long tow rope, but if there is only a shorter length of rope available the glider may overrun and smash into the back of the car, causing hundreds of pounds' worth of damage to the glider.

If towing is permitted with only a wing-tip man, it is vital that the pilots all recognise that this is only safe if the ground is more or less level and the wind is very light.

Strong wind conditions

In windy weather every effort should be made to avoid having to move the glider upwind; it is far safer and easier to land well into the field and then to move the glider back down wind. It is safe to push backwards, moving down wind with the nose into wind, provided that the airbrakes are open and weight is applied down on the nose. The effective wind-speed is reduced by the movement down wind and, as long as the tail is not held down, this is safer and easier than turning the glider right round. (Always put a knowledgeable and reliable person at the tail, and remind them only to hold the tail down if that is necessary to move the glider easily.) Towing forwards going down wind means that there is no possibility of being blown over, but the controls must be held or locked otherwise the control hinges may be damaged by the surfaces slamming across against the stops.

In very strong winds the critical place for ground handling is at the tail. Always make sure that the person on the tail is briefed to hold it up until someone has their weight on the nose. After coming to a stop with the glider facing into wind, holding the tail down is the worst possible thing, and even leaving the nose unattended for a few moments is dangerous. It is always safer to transfer the person on the tail to the nose, where his extra weight can be more effective. Many modern machines do not have hand holds at the tail and are very tail-heavy on the ground. Weight on the nose or in the cockpit will be sufficient to prevent the glider lifting.

There is always a tendency for pilots to relax as the launch point is reached. Unless the glider is going to be launched without delay, it should be turned out of wind and held with the into-wind wing down until it is needed.

Tail and wing-tip trolleys

Britain must be one of the only countries in the world where the club members manhandle the two-seater gliders all the way out to the launch point. Most private owners discovered the use of a tail and wing-tip dolly a long time ago, making it possible to tow out with a car single-handedly on most days. It is a harsh punishment to have to walk the glider all the way back, particularly after a cable break where the glider lands in the middle of the airfield. I am always surprised that clubs will happily buy an expensive tractor to pull gliders back, but will not provide aids to make it all less strenuous and time-consuming. The proper equipment makes the whole operation far easier and safer, and encourages instructors to practise those exercises which can so often result in a long walk back to the launch point. However, it is essential to recognise that

towing aids are only really safe for use in normal flying conditions, and caution is needed if they are used in windy weather.

Parking

If the wind can be trusted to stay in much the same direction, safe parking is an easy matter. With the lighter machines, the into-wind wing should be picketed or weighted with tyres or weights, and the tail-skid or wheel should be blocked to prevent the glider moving round into wind. The front skid or main wheel will also need to be chocked, and an easy, effective way of doing this is to run the main wheel into a rut in the ground. Parking with the airbrakes open is very little trouble and is helpful if the wind does swing. The canopy should always be locked down.

Gliders are often left for short periods with tyres on the wing-tip only. If this is done, the tyres should be right on the tip and not half on the ground, otherwise if the glider does move, the tip will slide out from under the tyre and be freed. This can be disastrous and may easily occur if there is no wind in the early morning when the gliders are parked outside the hangar with a single tyre on the wing-tip. Later, when the wind has picked up, the gliders weathercock round and can be free to tip over so that the into-wind wing is upwards. Another hazard is the wind swinging and increasing during the day so that the glider ends up parked facing directly into the wind.

If the glider is facing across the wind with the into-wind wing held down, the wind will be blowing on to its top surface, producing an extra down-load. However, in a strong wind several tyres are required to stop the into-wind wing lifting up. The upper tip will be high in the air where the wind is stronger, while the lower wing will be close to the ground where the wind is much lighter. The glider is not secure with only one light tyre on the wing-tip.

Blow-overs

If the glider is facing more or less directly into the wind, and there is a pilot in the cockpit, it is just as safe as it would be after a normal landing. Some people think that holding the wing down or putting a tyre on the wing will stop the glider blowing over. However, facing into the wind while waiting for a launch, a tyre on the wing-tip is just a convenient way of preventing the wing from lifting off the ground.

When conditions are very squally it is better to have the wings held level, with as much weight on the nose as possible. Having one wing down may result in a light glider being blown over if the wind changes direction and gets underneath the raised wing. Then, all the weight in the world on the wing-tip would not stop it going over.

When a blow-over does occur, you will always hear the people concerned state, quite truthfully: 'Up to that time the wind had been quite acceptable and then there was this bad gust . . .'. Of course, had the wind been very gusty before, they would already have stopped flying, or they would have taken extra precautions to make sure that there were enough people to prevent an incident. The moral is clear: when gustiness is getting near to the limit for safe

flying, assume that at any time it could suddenly increase. Stop flying before it becomes too windy to move or fly the glider.

Blow-overs were a common occurence in the early days with lighter gliders and they sometimes even happened on almost windless summer days. Although the gliders were left facing at right angles to the wind and were weighted down with tyres in the approved manner, when the first strong thermal went off nearby the wind would become gusty and change direction completely. This meant that the gliders were then parked the wrong way and, being light, they often blew over.

This kind of blow-over can only be avoided by manning the glider all the time or by tying it down with pickets, preferably with the wings level and all its control surfaces locked to prevent them flapping against their stops. This is standard practice in more tropical countries where there are 'dust devils' or 'willy willies' which can produce a 40-knot wind in almost any direction with little or no warning. Even the towplanes are taxied to a nearby picketing point and tied down properly between each flight.

Now that modern gliders are so much heavier and have their wings closer to the ground, it is fairly usual for private owners to park 90° out of wind with the into-wind wing up. Although perhaps vulnerable to strong winds in this position, in lighter winds it is stable enough to ensure that no tyres are needed. The result is that many glider pilots are becoming complacent about parking and on a really windy day it is not unusual to see gliders at risk, just waiting for the first really big gust of wind to blow them over.

The whys and wherefores of these procedures need to be explained to students, otherwise they might conclude that proper parking is not really important and that it is all right to leave a glider with either wing down.

Line squalls and thunderstorms

The worst situation for accidents is a good soaring day with a risk of thundery showers. This means that a large number of gliders will be rigged and brought out on the airfield. Then, when the first big shower starts, rather than stand under the wings in the rain everyone will desert the launch point for a cup of tea, leaving the gliders apparently well parked and weighted with tyres but, in fact, vulnerable to a change in the wind direction. Often, even after insisting that everyone goes back to the launch point, there will be barely enough people to hold all the gliders down, turn them around and re-park them if the wind changes. This is an easy way to have a number of gliders wrecked by the wind, but luckily it does not occur very often. The only safe solution is to get the gliders into the hangar before the squalls arrive, or to make sure that there are at least two people close to each glider all the time, ready to swing them round when necessary. Everyone gets very wet but it is worth while getting soaked if it saves even one glider from serious damage.

Finally, remember that if a cold front is due in the summer-time, it may be preceded by some hours by a line of unpredicted severe squalls and storms.

Overnight or long-term parking

In dry and settled weather conditions it is quite safe to leave gliders out overnight. However, permanent parking outside in all weathers has been shown to cause rapid deterioration to the finish of all non-metal gliders. Never risk parking out overnight without checking the weather forecast for a strong wind warning or the approach of a cold front.

Provided that all the controls can be locked to prevent them getting damaged by slamming against the stops, parking the aircraft facing down wind will be safest, because then the wing is meeting the airflow at a negative angle. In lighter winds they can be picketed out, facing into wind with the wings level.

For long-term picketing out, the main wheel can be run into a hollow or trench in the ground to reduce the wing incidence and to lower the wings still further. Wing covers will also help to reduce the lifting qualities, but they can damage the finish if they are allowed to thrash about in the wind.

Protecting the instruments

It is always worth while covering both the pitot and static vents to prevent rain entering the systems. However, it is unwise to seal them off completely with tape as a large change in atmospheric pressure may cause damage to some instruments. I usually make a tape hood over the static vents to allow them to breathe without letting water droplets get into the tubes. If this does happen, the only solution seems to be to disconnect the instruments and to pump air through the system to blow out the water and dry the tubing. Never blow down the vents or the total energy and pitot heads because this can destroy the instruments. The venturi-tube type of total energy system can be dried out by venting it to cockpit static to allow the venturi to suck out the water in flight. This leaves you with a working variometer but without total energy.

Always take precautions against rain. You never find out about the water in the instrument systems until you are airborne and it will ruin that flight, if not the entire flying for that day. It takes at least an hour to get the system clear and dry again, and is a very frustrating problem, particularly if it occurs in a competition.

Rigging and de-rigging

With the help of good rigging aids such as trestles and a stand for the fuselage, it is often just possible to rig with two people. However, it is always a little risky, especially if the ground is slippery or uneven. One slip may mean that the wing-tip is dropped, causing some very expensive damage to the wing or the fuselage structure and fittings. It is rarely an impossibility to find a third person, and in gusty weather this must make sense. Think how often you see two people struggling to rig or de-rig because they are too embarassed or independent to ask someone to help.

In the early days of gliding, trestles were not considered essential as an aid to rigging; I remember the very first ASW17 to arrive in the UK being rigged without them. Like most new machines, everything was a tight fit and by the

time we had the glider rigged, we had worn out several people with the sheer weight of the wings. Trestles make it all so much easier and safer, and it is worth while having a second one so that everyone can relax for a few minutes if it is proving difficult to align both wings to get the main pins in place. Trestles are also very useful for holding the wings level if the glider is being picketed overnight.

The routine for rigging and de-rigging is usually passed on by word of mouth, or is self-taught. As a result it is not unusual to see people doing things which increase the risk of serious damage if things go wrong. I have often seen pilots fitting the tailplane on before the wings. This ensures some very expensive damage in the event of the fuselage falling over, whereas without the tailplane very little or no damage is likely. If you put your tailplane on first, you might say, quite rightly, that this will not happen with your equipment. However, someone seeing you may do the same thing using a crude 'dead man' to hold the fuselage upright. If it falls over it will certainly be weeks before he flies again.

Make sure that the fuselage is secure and is not liable to move. In windy weather there will be a definite tendency for the fuselage to weathercock round into wind unless the tail-wheel or skid is chocked. Anything which makes rigging and de-rigging more difficult increases the risk of someone getting tired of holding up a wing-tip and so letting it droop or even drop.

The most common cause of damage when getting the glider out of the trailer and putting it back at the end of the day's flying is impatience, and the only answer is never to rig without an adequate number of people. If in doubt, get help, and don't rig until enough help is available.

Hangar rash

It is often said that more damage is done inside the hangar than out! This is often the result of inexperienced people trying to give a helping hand to get the gliders out. Usually the problem is that no one is really taking charge and telling the others exactly what to do. A quick but careful briefing would, in most cases, prevent incidents such as someone lifting a wing without first checking that the other wing will not come down on to another glider's canopy.

Moving through a confined space, for example if the glider is too large to go through the door, it is always wise to go nose first, swinging the glider right round and out with its nose close to one door. (Leading edges are much stronger than trailing edges or tailplanes and rudders.) Don't try to go out backwards unless there is ample space for the glider to go straight through.

Some hangars have doors at each end and these make a good wind tunnel if both ends are opened at the same time. Even in light winds there can be a venturi effect sufficient to blow the gliders about. Unless the wing-tips are weighted down with a tyre, one wing lifting off the ground means that the other will come down on to another glider with expensive results. Always close the doors at one end before opening them at the other, unless the wind is very light, and never leave both ends open in case a wind springs up later in the day.

Trailer towing

Unfortunately, most people learn about towing trailers by trial and error, which can prove to be a very expensive way of doing things. Every year a number of trailers are rolled over on our roads and trailer accidents account for a great deal of glider repairs.

Snaking

Glider trailers can be stable or unstable, depending on the car and the trailer combination. If a trailer begins to 'snake', the swinging often develops so quickly that within seconds there is no way of stopping it and avoiding going right off the road. Even a fairly stable trailer will start to swing if it overtakes or is overtaken by a large truck. The pressure wave from an overtaking truck strikes the rear of the trailer first, setting up a swing. In addition, the venturi effect between the two vehicles assists this swing and tends to suck the two vehicles together. This is particularly common on motorways where trucks are overtaking at quite high speeds. It is vital to have good side mirrors on the car in order to be aware of traffic which is behind or overtaking. Judging by the number of trailer accidents on the motorways, it may be wiser to keep off them whenever possible.

Factors which influence the stability of the combination include the softness of the car and the trailer's suspension, plus the balance of the trailer. It is a good idea to add an extra 5 or 10 p.s.i. to the pressure in the car tyres and to keep the trailer tyres at a higher pressure than might at first seem necessary. If you are building a trailer, fit a suspension rated for a trailer heavier than the actual weight.

The balance and dynamic stability of the trailer, loaded or unloaded, is affected by heavy items like spare wheels, which should be up front when possible. The ideal seems to be to have a down load on the tow bar of 10–15 kg (20–30lb). Anti-snake devices have been proved to be worth while. They work by stiffening the coupling between the trailer and car.

Many swinging and jack-knife accidents seem to start on slight downhill gradients, and particularly if the road surface changes or is uneven. Once the swinging has started, there is very little even a skilled driver can do. Slowing down does not help, and generally the driver is not brave enough or quick enough to try accelerating.

I learned about trailer driving the hard way during a competition retrieve, when an enthusiastic crew member took us off the road with an Eagle two-seater in the trailer. Both the car and the trailer were badly damaged, but because the glider was securely held in by the fittings, it survived the trailer going over on to its side without damage. As a result of this incident, I am very cautious and rarely drive above 80 k.p.h. (50 m.p.h.) with a loaded trailer. It is a frightening experience, and I have never heard of anyone doing it a second time.

With a trailer that you have not towed before, your first priority should be to explore its stability carefully. You can do this by driving on a quiet, wide road with no traffic about, gradually increasing your speed and moving the steering slightly to produce a very slight weave. As the speed is increased, the damping

becomes less and you will be able to decide on a reasonable limit to keep to for the first half hour. By then you will have become tuned in to the driving and will be better able to judge if it is safe to go a little faster. Remember to reduce speed on downhill stretches and to watch in the mirror for traffic which may be about to overtake, and which could therefore set up a swing.

Gears must be used more frequently with the extra weight of the loaded trailer, and it is important to change down in plenty of time to prevent having to brake fiercely. The major effects of the extra weight will be poor acceleration and a reduction in effective braking. Allow for greater braking distances with a loaded trainer and always use the lower gears going down steep hills. Many trailers are dangerous much above 80 k.p.h. (50 m.p.h.) and it is just not worth taking any chances going much faster. A flat or burst tyre can mean no flying for months!

Parking the trailer

Simply parking the trailer with the stands firmly down will not prevent really strong winds from doing irreparable damage. Trailers are usually safer if they are parked close together so that they protect each other. However, never park your trailer near one which has poor stands and is liable to swing in a wind. Ideally, every trailer should be anchored by the ball hitch on to a ball mounted in the ground. Alternatively, they need tying down securely at both ends. This should prevent incidents where trailers are blown for hundreds of yards and wrecked.

It is worth while designing trailer fittings so that the glider is held firmly in place even if the trailer rolls over. Often, the only cause of damage to the glider is if the wings or fuselage break loose. It is also a good idea to make covers of some kind for the trailer tyres. These tend to rot in the sun and though the treads might be as good as new, they will have to be changed because of the cracks in the walls.

Conclusion

The main thing to realise with trailer driving is that it only takes one mistake to wreck the trailer and a nice glider, as well as possibly writing off a new car. Clearly, it is important to consider each of the ways in which you can safeguard your equipment because it is no use avoiding all the flying hazards if you are going to write off your glider on the ground. Repairs take time and money to carry out, and if they can be avoided gliding will be less expensive in the future.

Cockpit checks

There was a time when many gliding instructors scorned the use of a rigid drill, and taught their students instead to check everything logically by going round the cockpit from left to right. The disadvantage of this method is easily demonstrated by asking the students as they finish if they are sure that they have not forgotton something. They will then start all over again and go round the cockpit a second or even a third time.

This can easily be avoided if a simple, systematic check is followed. Thus if you go through a drill of vital actions, or check-list each time, you will ensure that you do not forget any item. You can then take off with complete confidence, knowing that you have checked all the really vital things for the flight. However, this confidence is only justified when the check is done systematically and correctly. For example, checking the items in the wrong order is totally unacceptable because it can so easily lead to missing something out altogether. A re-check should never be necessary, since this only implies the acceptance of a half-hearted check in the first place.

The idea of having the person attaching the cable ask if the airbrakes are closed and locked has been introduced in some clubs to try and prevent incidents where pilots take off with their airbrakes unlocked. However, if you are going to re-check the airbrakes, it would seem logical to check all the items in the check-list as well.

Many instructors are not careful, or thoughtful enough about either their initial teaching or their subsequent monitoring of their students as they do their own cockpit checks.

In the UK the pre-take off checks are standardised and remembered by the mnemonic CBSIFTCBE. Each letter represents a vital item to be checked, i.e.

C – Controls	I – Instruments	C – Canopy
B – Ballast	F – Flaps	B – Brakes
S – Straps	T – Trim	E – Emergencies

Long before going solo the student should have learned the mnemonic by heart. It is a good idea to say the key words aloud every time as you check each item so that it becomes a habit. If you do this when you are solo, you will be less likely to skip an item or become careless about the checks when you are more experienced.

It is important for every student to understand the philosophy behind having a rigid drill and the reasons for precise actions such as checking and locking the airbrakes. Without a convincing explanation and an insistence that the checks must be done properly, many students will become careless and slap dash when they are on their own and away from close supervision. All aspects of flying require this combination of understanding and self-discipline, and the vital actions make a good starting point.

It is also important to differentiate here between the first flight of the day and subsequent flights. A careless daily inspection after rigging may easily leave the glider with one aileron or the elevator disconnected. The control check is often better done initially *before* the vital actions, perhaps even before getting into the cockpit, when the control surfaces can be seen more easily. On the other hand, the check for full and free movement must be done *after* strapping in, because it is possible in some aircraft to jam the controls by tightening the straps round a cable or control rod.

The importance of the vital actions drill may even be undermined in the eyes of the student if the instructor insists on a complete check of each control movement for every flight (stick to the left, left aileron up, right aileron down, stick to the right, etc.), since it is clear that things like this cannot change between flights, and the majority of experienced pilots only do that check on the first flight of the day. I think that the instructor should treat the first flight on a particular glider as if it was the first flight of the day, and on subsequent flights he should just check for full and free movement and that the surfaces are moving fully. At the same time he should check that he can reach the full rudder and stick movements without undue stretching, and that cushions or other objects are not limiting the movements of the controls.

The canopy

An incomplete or sloppy check carried out on the canopy can be lethal, because if it comes off it is a matter of luck whether it hits or misses the tail. In addition to checking the canopy lock for security, it is essential to push up on the perspex itself to confirm that the hinges or pins are secure. It has been known for the hinges on a canopy to fail or for poorly designed and faulty catches to fail in flight, resulting in a lost canopy. Most of these expensive incidents might have been avoided by this drill.

The airbrakes

The method of checking that the airbrakes are correctly locked is all-important. Since the majority of modern machines have airbrakes which are held closed by a geometric lock, it is essential that the method of checking them must be foolproof for this kind of system.

First open the brakes or spoilers fully, checking them visually whenever this is possible. Then close them with a firm push on the lever in order to establish the habit. The pilot should be able to feel the geometric lock operating just after the airbrakes are flush with the wing surface. In some cases there is a gate for the lever to go into once the brakes are correctly locked.

This operation needs to be explained and demonstrated to every student. It must be understood that unless the geometric lock is felt, either the brakes are not locked, in which case a harder push is needed on the lever, or the locks themselves need adjusting. If it is the latter, the aircraft is unserviceable and must not be flown until the brakes have been re-adjusted.

If the basic training is being done on a Falke, or on any other type of glider

fitted with simple spoilers or airbrakes which do not have a lock, the differences must be explained. However, the method of checking should be just the same in order to establish the right habit.

The cause of almost every incident where the airbrakes open during the launch is that the pilot has failed to lock them correctly. The amount of force needed to lock them will vary considerably from aircraft to aircraft and even perhaps from day to day. Merely pushing the lever forwards as far as it will go is not enough because the lock may be very stiff. Modern gliders usually have spring-loaded caps which are pulled down firmly to prevent air leaking into or out of the wing. This makes the lock much stiffer to operate than on the earlier types of glider.

A geometric lock which requires no force to lock is seriously out of adjustment. It may allow the airbrakes to open during a launch if the lever is knocked or if one side is unlocking a little before the other.

However, despite careful instruction, there will still be incidents in which the airbrakes open during a launch. On a wire launch the best hope is for the car or winch driver to build up extra speed to get the glider as high as possible. This gives the glider pilot more time to find out why his glider is semi-stalled and is sinking like a brick. With an aerotow, if the towplane pilot realises that the airbrakes are open, he can signal to the glider pilot by rapid rudder-waggling. In both cases this is a real emergency, because in the event of a cable break the pilot does not have time to realise what is wrong, and he may well stall and spin if he flies by attitude and tries to turn without checking the actual speed.

Emergencies

It is too late to consider what to do in the event of a launch failure after you have left the ground. Before take off, always ask yourself whether there are any special factors to consider which may affect the actions to be taken in the event of a cable break or other kind of launch failure. Check the actual wind direction and consider how it will effect your launch. Which area of the field is unobstructed for a landing? Many accidents occur to pilots who do not consider the best options before they start the take off. With winch and car launching it is a good philosophy to consider every launch as a potential failure so that you are ready for every eventuality. A few moments thought considering these things just before take off can prevent a launch failure becoming an unexpected and unplanned emergency.

Taking your time

Pilots sometimes complain about being rushed through their cockpit drills. Ideally, you need a few minutes to settle comfortably before setting off, but if you have to rush you can usually blame yourself for not getting in before the cable or towplane arrives. Whatever happens, don't rush those vital actions. They take less than 30 seconds to do and they should be left until the last moment before the cable or rope is attached.

Swinging and ground looping accidents

The pilot's responsibility

During the last few years there has been an increase in swinging and ground looping accidents and these must be analysed to see if there are new lessons to be learned.

In one instance, a young pilot started a launch with another glider standing only a few yards to the side and just ahead of the take-off point. With a normal take-off the glider would have cleared the obstruction. However, it should have been obvious to the pilot, and to everyone at the launch point, that with either a swing or a wing-drop there would almost certainly be a collision. Unfortunately, the glider did start to take-off, it did drop a wing and swing, and there was a collision.

Where there is a slight risk in the event of a swing, a pilot may be said to have made a simple error of judgement or taken an unnecessary risk. However, in the aforementioned case I think we must look further for the factors influencing the pilot.

When students are learning to glide, the instructor is not only teaching them the technique of flying a glider, but also how to make decisions and judgements in the air. The final stages of training amount to the handing over of all the responsibility for safety to the student. Ideally, the student should be making all the decisions and choosing actions in the interests of safety and efficiency.

By setting the student problems during the final flights before going solo, the instructor can test his ability to think logically and to deal with situations as they arise. An experienced instructor will stop helping the student at this stage and will refuse to comment until after each flight. In this way, the student can gain confidence by knowing that he made the decisions and that they were sensible ones. As he reaches the first solo stage, therefore, the pupil must either achieve a standard of flying which does not leave room for criticism, or he must learn to accept the particular instructor's comments as fair and helpful.

In the air, decisions are relatively easy and concern only the student and the instructor. On the ground, however, the situation is not so simple. Even with ground handling someone must take charge, but it may not be the pilot. A young and inexperienced pilot may not feel able to take command of the situation and so prevent a stupid accident or an unnecessary risk being taken. Nevertheless, he should try and take control and tell the other handlers what to do.

Inhibiting situations

Whereas in the air pilots may make good decisions and behave responsibly, on the ground they may feel that each move is being watched and criticised by the

other members. This will make them less decisive and may inhibit them from giving orders or taking charge of the situation. Since it is quite unusual to need to stop a launch, a shy person would certainly hesitate about shouting out.

Many incident and accidents of this nature would be prevented by expert supervision on every flight. However, 100% supervision, even of early solo flying, is impractical for 365 days in the year as there are bound to be moments when the instructor's attention is diverted.

The real solution is to train pilots to accept responsibility, whether they are sitting in the aircraft or are merely bystanders at the launch point. The more timid personalities must be encouraged to take charge and to give orders. When there is an opportunity during training for the pilot to decide whether or not a situation is safe, they must be taught to assume that the worst will happen, and then to assess whether there is a risk or not. The rather shy students must be encouraged to shout the launching orders clearly and loudly, so that if they need to shout 'stop', they do not hesitate because they are reluctant to raise their voice.

Too often the instructor may allow a take-off when there is an object to one side. This would certainly be a hazard in a cross-wind and, to an inexperienced pilot, in any wind direction. In these cases the student probably relies on the instructor to make the decision and knows that he is there and can save the situation if things go wrong.

It is important to make the student aware of the subtle difference between being safe at all times and being safe in particular conditions. Above all it is vital for every pilot to have the old adage 'safety first' indelibly imprinted on their mind. In other words, if in doubt, don't take a chance. The mature glider pilot would never hesitate to make a fool of himself in the interests of safety.

However, it is not just beginners who make mistakes and get caught out. On one occasion a very experienced pilot in a Nimbus 2 was starting on a car launch when it swung off the runway into a K8 which was some distance ahead. There was a very light cross wind from the right which caused a swing in that direction, and as the Nimbus has only a tail-skid, it swung as it started its take-off run. The pilot released the cable but could not keep the glider straight, or stop in time to prevent the collision. The Nimbus was undamaged but the K8 had one wing severed at about half-span as well as other serious damage.

Realising that the take-off would involve an element of risk, the Nimbus pilot had, in fact, refused to go at first, and had asked for the K8 to be moved. After it had been moved a short distance away, the pilot was persuaded that the situation was all right and he accepted this, rather than face being unpopular for causing further delay.

The accident caused considerable consternation and it became clear, talking to the members present at the launch point, that many pilots did not really understand all the factors which caused the accident. Obviously, the Nimbus pilot was at fault for allowing the other people at the launch point to influence his judgement. Perhaps the most important point is that, regardless of who may be at the launch point, the pilot alone bears the responsibility for accepting or rejecting the launch in the light of the situation as he sees it from the cockpit. If he has the slightest doubt about his ability to launch safely, bearing in mind such hazards as swinging to one side or a cable break at any stage, then he must refuse the launch. Moreover, if a pilot decides not to launch in a situation like

this, he must never be overruled or criticised for playing it safe. Of course, this accident would not have happened if someone at the launch point had seen the danger and shouted 'stop'.

Accidents due to swinging on take-off and landing are so common that it is worth studying the causes in detail. The behaviour of some modern gliders during take-offs and landings is very different to most of the training gliders, and it is vital to understand why they are more prone to swinging.

Cross wind effects

The two main effects of a cross wind on the ground run are well known. The first is that the wind tends to lift the upwind wing-tip and the second is that the glider tends to weathercock into the wind. This applies to every type of aircraft and not just to gliders.

Light cross winds, and in particular those with a slight down wind component, create by far the most treacherous conditions for both take-offs and landings. If there is a cross wind, there will be a tendency for the glider to start to swing, while if there is a down wind component on take-off, it will take the glider longer to gain enough speed for the controls to become effective.

Prevention is always better than cure. The person holding the wing-tip should always run the down wind wing-tip so that any pull that he may exert is against the weathercocking swing into the wind. He should hold the down wind wing-tip a little above the horizontal and be prepared to run with it, not just balance it and let go. Once again it is up to the pilot to insist that this wing is held and not to accept someone on the upwind wing-tip.

The pilot himself can help anticipate the swing into wind by applying full out-of-wind rudder before he starts to roll. As the controls become effective, the amount of rudder will have to be reduced long before full flying speed is reached.

A bad swing can easily lead to a serious ground loop or even to cart-wheeling and a broken glider. This can only be avoided by releasing the tow promptly before the situation develops. Always keep your left hand close to the release toggle until you are sure that the glider is stabilised, i.e. in a modern machine until the tail has come up.

Strong cross winds

Unless the wind is more than about 45 ° to the direction of take-off, a strong cross wind seldom creates problems. This is because good control is reached at a much lower ground speed. Provided that there is normal acceleration on take-off, the pilot should have good aileron control and be able to stop any swing into the wind by means of the rudder.

Of course, there is a definite limit to the strength of cross wind that can be accepted by some machines, particularly those fitted with tail-skids rather than tail-wheels. The main precaution is always to leave plenty of room on both sides of the take-off path to allow for a possible swing. Room must be left on the upwind side in case there is a cable break or premature release, and on the down wind side in case the wing touches and causes a swing that way. If the

wing-tip touches long grass or rough ground, there will certainly be a bad swing and the launch will have to be abandoned.

The most serious swings and cart-wheels usually occur when the wind gets under the wing-tip so that the down wind tip scrapes along the ground. A few seconds later, as the glider gains speed, the full aileron suddenly takes effect. If this happens at the same time as the inevitable swing into wind, it can result in a very rapid rolling over on to the into-wind wing-tip. By then the glider may be airborne and a cart-wheel will be unavoidable. This situation can be prevented by being prepared to release immediately if things start to go wrong, or by being ready to stop the wing coming up suddenly.

Following serious accidents in a number of countries, it is now agreed that the only really safe thing is to release at once if a wingtip touches the ground. It only takes a few minutes to pull the cable or rope back and to be ready for another launch.

Tow-rope loads

On a car or winch launch, the pull of the rope or launching cable exerts very little stabilising effect, but the rapid acceleration usually ensures that enough speed is gained to have good control.

A nose hook provides more stability for aerotowing, and it is a slight advantage to start the take-off a little on the upwind side of the towplane. This ensures that there is a sideways pull on the nose, helping to prevent both the glider and the towplane from weathercocking into wind. The poor acceleration of an aerotow makes a swing or a wing-drop more likely.

Directional stability

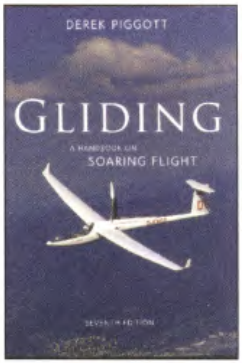
In flight

In flight, the directional or weathercock stability is maintained by the fin and rudder, which provide extra side area behind the c.g. Thus with the aileron and rudder held in a central position, a glider will always weathercock into line with the relative airflow, just as the wind vane on a church steeple will always swing into the wind. When rudder is applied, the nose of the glider yaws to the side until the force produced by the rudder is balanced by the tendency for the aircraft to swing back into line with the airflow. (In the air this is nothing to do with the actual wind. The aircraft is flying in a mass of air which may be stationary or moving.)

If an aircraft is very directionally stable because of a large fin, then the rudder will be less able to produce a large angle of yaw before this balance of forces occurs. With a smaller fin, the directional stability will be weaker, the rudder will be more effective and the angle of yaw will be far greater.

On the ground

When a glider is on the ground it does not pivot around its c.g. as it does in



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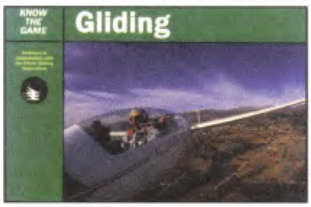

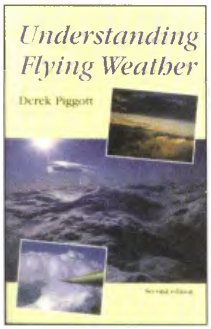

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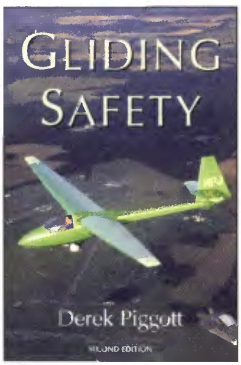

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From1953 to 1989 Derek Piggott MBE was Chief Gliding Instructor at the Lasham Gliding Centre, one of the largest gliding centres in the world. Derek pioneered the use of motor gliders for training, and was influential in having them approved for use in several countries. He is now a consultant and continues to write and to lecture worldwide.

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