

Safe winch launching



This guidance has been developed from the BGA's Safety Initiative winch launch accident study. It also draws upon Chapter 16 of the BGA Instructors' Manual. The advice contained in this booklet highlights the key risk areas in winch launching and offers simple but effective guidance on how to minimise these risks.



BGA records since 1974 include 36 fatal injuries and 74 serious injuries from accidents associated with incomplete winch launches. 283 gliders, about 8 per year, have been destroyed or substantially damaged in winch accidents in that period...





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INTRODUCTION

BGA records since 1974 include 36 fatal injuries and 74 serious injuries from accidents associated with incomplete winch launches. 283 gliders, about 8 per year, have been destroyed or substantially damaged in winch accidents in that period.

Following an analysis of winch accidents and new studies of the mechanics of winch launching it seemed likely that accidents could be reduced if pilots and instructors were offered additional guidelines on the hazards of winch launching and how to manage or avoid these hazards. A BGA safe winch launch initiative was launched in October 2005. The initiative included advice to instructors and the distribution of 9000 copies of a leaflet on how to winch launch safely.

During the first 3 years of this initiative from 2006-2008 there were 2 fatal or serious injury winch accidents whereas 7 would have been expected if the previous rate had continued. The number of destroyed or substantially damaged gliders was halved at 10 compared with the 21 that the previous rate would have indicated.

These results were heartening but in 2009 the winch accident rate reverted to the historical average.

The majority of the most serious winch accidents result from a cartwheel on the ground, an accelerated stall during rotation, or a stall or spin after power loss. This booklet contains advice to avoid these and other winch accidents. It combines advice from the January 2007 leaflet together with material from the BGA instructors' manual. The most critical elements for staying safe are:

- If you have difficulty in keeping the wings level before take-off, release before the wing touches the ground.
- After take-off, maintain a shallow climb until adequate speed is seen with continued acceleration. Then allow the glider to rotate at a controlled pace. If power is lost near the ground, immediately lower the nose to the appropriate recovery attitude.
- After power loss in mid-launch, adopt the recovery attitude, wait until the glider regains a safe approach speed, and land ahead if it is safe to do so.

36 fatal injuries
74 serious injuries
283 gliders destroyed or substantially damaged

CHARACTERISTICS OF WINCH ACCIDENTS

A winch accident is defined as an accident that is associated with a winch launch which for any reason does not proceed to the usual height.

Since 1974 a total of 705 such accidents and incidents have been reported to the BGA. 33 resulted in fatal injury and another 66 resulted in serious injury. 283 gliders were destroyed or substantially damaged.

Many winch accidents arise as a result of power loss at the glider. This can be for any reason, including winch fault, cable break, cable snarl-up, and cable release by the pilot or instructor.

The overwhelming majority of winch accidents result from a very few circumstances:

- Wing drop on the ground followed by groundloop or cartwheel.
- A stall during rotation followed by wing drop or a flick roll to inverted flight.
- Power loss below 100 feet followed by a stall or a dive into the ground.
- Power loss in mid launch followed by a stall and spin.
- Power loss in mid launch followed by a recovery to controlled flight and then an overshoot, undershoot, or a collision during landing after a demanding circuit.
- Getting tangled up with the cable on the ground, or hitting it in flight.

The main sources of fatal injury are a stall during rotation and a spin after power loss in mid launch. The main sources of serious injuries are these two groups and also a stall after power loss below 100 ft.



THE INITIATIVE: INITIAL RESULTS AND NEXT STEPS

The BGA safe winch launch campaign has been running since October 2005. The first three years saw a marked reduction in the number of serious winch launch accidents:

- **There were two fatal or serious injury accidents, both from cartwheeling on the ground. At the 1974-2005 rate a total of 7 fatal or serious injury accidents would have been expected.**
- **No fatal or serious injury accidents occurred from uncontrolled flight (stall/spin or dive into the ground) whereas at the 1974-2005 rate 6 or 7 would have been expected.**
- **Four gliders were destroyed or substantially damaged from a wing drop followed by a groundloop or cartwheel. This crash rate is the same as that from 1974-2005. One of the crashes was fatal and one led to serious injury.**
- **The crash rate was approximately halved (actual 10, expectation 21).**
- **Instructing accidents continued.**
- **Lesser winch launch accidents and incidents continued.**

We should not be complacent about these improvements. One of the 10 crashes involved a spin on a trial lesson and could have been a double fatality had the arrival not been cushioned by a tree.

In another one of the crashes the pilot escaped without injury when the glider stalled after it had been allowed to rotate into a climb following a back release. In an incident without damage, the glider stalled because the pilot inadvertently pulled the stick back during rotation when he slid backwards up the seat. In another incident, the glider stalled because insecure ballast jammed the stick in a rearward position. Fortunately the alert pilot was able to move the ballast. Four canopies opened during launching.

Pilots and instructors did well to reduce winch accidents in 2006-2008. Unfortunately the winch accident rate in 2009 reverted to the historic average. The challenge for 2010 is to drive the rate down to a level even lower than that achieved in 2006-2008.

This booklet is part of a communications package on how to winch launch safely.

In the space available the booklet cannot cover all aspects of safe winch launching. Site specific factors (for example, a winch with low cable speed or low power) may call for a modified technique. If you have any questions please consult an instructor.

A downloadable copy of this booklet together with a quiz and videos of simulated winch accidents are available on the BGA website.

This edition of the booklet includes guidance on operating the winch.

SAFE WINCH LAUNCHES

1. ON THE GROUND

HAZARD: Wing drop followed by groundloop or cartwheel.

If the wing drops on the ground the glider may rotate about the wing tip and cartwheel. After the wing has dropped the cartwheel can be so rapid that no recovery by releasing or other means is possible. You need to anticipate and pre-empt this hazard by conducting the launch with your hand on the release. Release immediately and before the wing touches the ground if it is not possible to keep the wings level.



You can see a video simulation of a wing drop and cartwheel on the BGA website:
www.gliding.co.uk/safewinchlaunching

Advice:

- Start the launch with your hand on the release.
- If you cannot keep the wings level, release immediately.

Practical considerations:

The essential with every winch launch before take-off is to **keep the wings level**.

A wing drop may result from yaw at the very beginning of the launch. Reducing the potential for yaw should therefore reduce the chance of a wing drop. The magnitude and the direction of yaw can be anticipated by considering any crosswind, the position of the cable on the ground, whether the hook is offset to one side, and which wing tip is held. Moderate temporary yaw at the beginning of the ground run can be accepted. In most cases the cable will pull the glider straight.

The wingtip holder should run with the tip while holding the wings level. This is especially important for large span and/or low wing gliders in light winds and in cross winds. In a cross wind it is usually advisable to hold the downwind wing.

In some wing drop accidents the pilot had not realised that the wing has dropped. Be aware of the importance of monitoring whether the wings are level.

If you need to release you must be able to do that instantly. That means being strapped in tightly, with no soft cushions, and with your hand firmly on the release.

It is important to understand that "if you cannot keep the wings level, release immediately" means release before the wing touches the ground.

The acceleration on many winches is so rapid that there is often no time to adjust the pitch attitude precisely, and this too can be accepted if you keep the glider in an approximately level attitude and allow the glider to take off when it is ready.

10% of fatal and serious injury winch accidents are first flight on type. Even if you are an experienced pilot, ensure your first winch launch on a type is made after reading the Flight Manual, a thorough briefing, and in benign weather conditions.



2. ROTATION

HAZARDS:

1. A stall during rotation followed by wing drop or a flick roll to inverted flight.
2. Power loss below 100 feet followed by a stall or a dive into the ground.

Stall during rotation

Accidents from a stall during rotation are very rare but often fatal.

During the transition from level flight at take off to the full climb the wing must generate a force sufficient to accelerate the vertical speed of the glider from zero to about 40 knots.



If a stall occurs during rotation it will be a dynamic or high speed stall after which the glider may flick roll. The glider is spinning while attached to the cable. The rolling of the flick roll is the autorotation of a spin. In some cases the glider hits the ground inverted with the cable still attached. Once the glider has stalled, recovery is probably impossible. You must anticipate and pre-empt this hazard.

A stall during rotation results from a low airspeed combined with a *rapid rotation rate*.

A glider with a 1g stalling speed of 34 knots will stall at about 50 knots during rotation on a winch launch if the rotation rate is 20° per second. The stall speed will be about 45 knots if the rotation rate is 15° per second.

A low airspeed and a high rotation rate can arise from a too rapid rotation at low airspeed, or from a rotation with an airspeed that was initially adequate but which reduces during the latter part of the rotation.



You can see a video simulation of a stall and flick roll during rotation on the BGA website:
www.gliding.co.uk/safewinchlaunching

Advice to avoid a stall during rotation:

- **Avoid taking-off with a significant amount of yaw present.**
- **Maintain a shallow climb until adequate speed is seen, with continuing acceleration.**
- **Ensure that the transition from level flight at take off to the full climb (typically 35°) is controlled, progressive, and lasts at least 5 seconds.**

Practical considerations:

Ensure you are adequately strapped in and that there is no chance of you inadvertently pulling the stick back during rotation because you are sliding up the seat to the rear. This is possible on some types, including the Cirrus.

Resist the temptation to pull the glider off the ground when taking off over bumpy ground in a light wind or with a tail wind.

Maintain the glider in a shallow climb (10 to 15 degrees) until you achieve the predetermined minimum safe airspeed on the ASI (typically 1.5 times the stalling speed) and you feel continued acceleration. This may require a substantial push on the stick, especially if you are a light pilot, flying with a C of G towards the rear, and/or the acceleration is rapid, or you are flying a glider with the hook well below the C of G (eg a K8).

Having achieved the minimum safe speed, typically 50% above the stalling speed, allow the glider to rotate into the full climb at a controlled pace.

Continue to monitor the airspeed. If it starts decreasing, reduce the rate of rotation.

Be aware that with competent winch driving many gliders will take off and rotate into the climb in a safe manner of their own accord. You may think you are controlling the winch launch profile but this may not be the case. This is one reason that many simulated launch failures are essential before solo.

There is not enough time on a winch launch to adjust the flap setting. Carry out the whole launch with the flap setting recommended in the flight manual.



Power loss below 100ft

Accidents resulting from power loss below 100ft are common. The serious accidents often lead to compressed vertebrae. Usually the glider lands in a stalled state but in 20% of the accidents the glider hits the ground nose first, unstalled. 40% of these power loss accidents are during instructional flights usually when simulating a cable break.

A glider with an L/D of 25 that suffers power loss in a 25° climb at 55 knots might not appear to be vulnerable if the pilot lowers the nose at 0g to a 10° recovery dive but delay in lowering the nose may result in a stall. If there is no delay the airspeed at the beginning of the recovery dive when the 1g stalling speed is restored is a healthy 49 knots. With a 2 second delay the airspeed will be 34 knots and the glider will probably crash.

After power loss below about 70 ft a single mistake of lowering the nose too little or too much, or being one second too late in lowering the nose, can make a crash inevitable. This is what happened in many of the instructing accidents. The student made a mistake and the instructor did not take over in time to initiate a recovery.

Typical combinations of airspeed and height which should provide sufficient energy for a safe recovery after power loss in a K13 are 55 knots at 20ft or 50 knots at 50ft. In a turbo or water ballasted glider the desirable minimum energy after power loss is probably about 60kt at 50 ft.

Advice to recover after power loss below 100ft:

- If the launch fails, immediately lower the nose to the appropriate recovery attitude. Minimising the reaction time is crucial.
- Do not use the airbrakes unless the glider has attained an appropriate attitude combined with a safe speed.
- Instructors: simulated power loss with less than 50ft and 55kt must be by instructor demonstration only.

Practical considerations:

Avoid ever being too low, slow, and steep. This can be achieved by following the same launch profile guidelines as those on page 7.

In a cross wind, wait until you have climbed to about 300ft before correcting for drift.

If power is lost, the imperative is to lower the nose immediately to the correct recovery attitude. Every half second counts. You need to anticipate power loss on every launch and be ready to lower the nose without delay.

After power loss very near the ground it may not be possible to achieve the approach speed. Be aware that previous habits might lead you to open the airbrakes at an unacceptably low airspeed. If the airspeed is very low you will need to make a brakeless landing. If the airspeed is a little higher it may be safe to crack the brakes. Do not release the cable unless you have time to spare. It will safely back release.

Excess speed near the ground

Do not be overly concerned about exceeding the placarded maximum winch launch speed during the early part of the winch launch. The relatively low placarded maximum winch launch speed of many gliders is to protect the glider from undue stress near the top of the launch where the lift opposes a large tension in the cable, there is no bending relief as there would be in a high g manoeuvre in free flight, and the stress from a gust is greater than in free flight. During the first third of the launch the stresses on the structure are moderate and the placarded maximum launch speed may be temporarily exceeded with care.

Advice:

- If the speed is excessive near the ground, climb gently to several hundred feet and release, or signal if the excess speed is now moderate. Releasing below 100ft could be hazardous, not least from hitting the cable. Signalling could overstress the tail. Pulling back to control the excessive speed may break the weak link leading to a difficult recovery.

Practical considerations:

If you find yourself in a shallow climb near the ground with excessive speed just maintain the shallow climb until you are at several hundred feet. If you release at this height the glider and cable should separate safely. If the excess speed is now moderate, you may wish to signal.





3. MAIN CLIMB

HAZARDS:

1. Power loss followed by a stall and spin.
2. Power loss followed by a recovery to controlled flight and then an overshoot, undershoot, or a collision during landing after a demanding circuit.

Power loss and stall/spin

After power loss in a steep climb at several hundred feet, the attitude of the glider at the beginning of the recovery dive may look satisfactory but the airspeed may be at or below the stalling speed. It is essential to maintain the recovery dive until the approach speed is restored. If the glider is manoeuvred before this acceleration has taken place it may stall and spin.

Sudden power loss usually produces an unmistakable sensation but a reduction in winch power, or surges in winch power, may have a less obvious impact on the airspeed. It is important to monitor the airspeed and to be aware of these modes of failure.



You can see a video simulation of power loss followed by a stall and spin on the BGA website:

www.gliding.co.uk/safewinchlaunching

Advice:

- Adopt the recovery attitude; do not turn or use the brakes until the approach speed is attained.
- Land ahead if it is safe to do so.

Practical considerations:

When faced with a reduction in airspeed in the full climb, unload the wing by relaxing the back pressure. If the airspeed falls to your predetermined minimum the best course of action is usually to release and to follow cable break procedure.

After a power failure and a push over to a recovery dive it can typically take 5 seconds to restore the approach speed. That can seem a long time. When you have achieved the approach speed land ahead if it is safe to do so. If not, turn in the direction you decided before take-off. Release the cable when time permits.

Power loss, recovery, circuit

Many accidents occur after a successful recovery to controlled flight following power failure in mid launch. The ensuing circuit may be difficult, with the glider at a few hundred feet at the upwind end of the field.

Advice:

- Plan provisional circuit options before taking off.

Practical considerations:

Think about the circuit options before every take-off. At some sites the best option might be an off field landing. **If you are an instructor and the circuit planning by P2 is not correct, take over early.**

4. FOULING THE CABLE

HAZARD: Getting tangled up with a cable on the ground, or flying into the cable.

Since 1974 over 100 launching gliders have encountered a winch cable. One accident was fatal and 4 led to serious injury.

Practical considerations:

Release immediately if your glider overruns. Stop the launch if you see an overrun.

Be aware that, after a release near the ground, the cable parachute will open and you may fly into the cable. For this reason it is advisable to climb to a few hundred feet before release if the speed is excessive in a shallow climb near the ground.

If practising simulated launch failures below 200ft, do this by arranging for the winch driver to reduce power.

If you are simulating a launch failure by releasing the cable at 200ft or higher, release under tension to ensure the glider and cable separate. Do not lower the nose before release.

If you are driving the winch and see the cable detach from the glider in the early part of the launch, chop the power and let the cable fall onto the ground. Only wind it in when you are sure it is safe to do so.





5. WINCH OPERATIONS

Safe winch launches may not be possible if the glider is accelerated too quickly. The glider should be provided with the ideal accelerations and airspeeds at each stage of the launch. This is where the winch driver can contribute to safety.

A too rapid initial acceleration might cause the glider to rotate too rapidly in spite of efforts by the pilot to contain that rate of rotation. Over-rotation is more likely with a powerful winch, rapid throttle movement, excessive initial power setting, light synthetic cable, stretchy cable (eg rope), a light glider, a high and aft C of G position, and a low and aft hook position.

Particularly with modern powerful winches, always ensure you use the correct throttle setting on each launch for the glider type and conditions. Advance the throttle smoothly taking a minimum of 2-3 seconds (3-4 seconds with a powerful winch and synthetic cable/rope). If the circumstances indicate possible over-rotation consider taking longer to advance the throttle. Seek feedback from the pilots you launch to determine whether your accelerations and speeds are ideal.

It is desirable for clubs to appoint a winchmaster who can ensure the equipment is fit for purpose and drivers are correctly trained.

All winch drivers, whether pilots or not, should be familiar with the advice in the whole of this booklet. In particular they should read this section and the last paragraph of page 11.

6. BGA SAFE WINCH LAUNCHING WEBSITE

Study the video clips and answer the quiz questions.



There are 5 video clips on the BGA website. Even if you have already seen some of these it's worth studying them again to remind you how and when things can go wrong:

www.gliding.co.uk/safewinchlaunching



Quiz

When you've seen the videos try doing the interactive quiz to re-enforce the messages in this booklet:

www.gliding.co.uk/winchquiz

SUMMARY OF GUIDELINES

Truncated advice, shown on page 13 is necessarily simplified.

Site-specific factors may require many other considerations; however, the key points listed, if rigorously applied, should help to prevent many sad and unnecessary winch launch accidents.

Pilots should consider the hazards shown on page 13 before every winch launch.

STAGE	HAZARD	AVOIDANCE	PRACTICALITIES
Ground Run	Wing touches the ground, glider cartwheels or ground loops violently.	<ul style="list-style-type: none"> Start the launch with your hand on the release. If you cannot keep the wings level, release immediately. 	<ul style="list-style-type: none"> Strap in tightly. Be aware of the second cable. Release if the glider swings too close to it during the ground run. Anticipate yaw. Hold correct wing. Run with tip. Monitor wings level. If wing drop release before the wing touches the ground. First flight on type in benign conditions.
Rotation	Stall/spin during rotation.	<ul style="list-style-type: none"> Avoid taking-off with a significant amount of yaw present. Maintain a shallow climb until adequate speed is seen with continuing acceleration. Ensure the transition from level flight at take off to the full climb (typically 35°) is controlled, progressive, and lasts at least 5 seconds. 	<ul style="list-style-type: none"> Do not pull back to reduce ground run over rough ground or with tail wind. Be prepared to use whatever forward stick may be necessary to maintain a shallow climb until speed is adequate. Monitor the airspeed; reduce rate of rotation if appropriate.
	Stall or heavy landing after launch failure below 100ft.	<ul style="list-style-type: none"> If the launch fails, immediately lower the nose to the appropriate recovery attitude. Minimising the reaction time is crucial. Do not use the airbrakes until the glider has attained an appropriate attitude combined with a safe speed. Instructors: simulated power loss with less than 50ft and 55kt by instructor demonstration only. 	<ul style="list-style-type: none"> No cross wind correction below 300ft. If speed is excessive do not release; maintain shallow climb to a few hundred ft and then release or signal. Beware habitual opening of airbrake; use airbrakes with care or not at all after launch failure. Do not release the cable; allow it to back release.
Climb	Stall or spin, after launch failure.	<ul style="list-style-type: none"> Adopt the recovery attitude; do not turn or use the brakes until the approach speed is attained. Land ahead if it is safe to do so. 	<ul style="list-style-type: none"> If airspeed reduces, unload the wing; consider releasing if airspeed approaches 1.5 times stalling speed. It typically takes 5 seconds in the recovery dive to accelerate to the approach speed.
	Controlled flight achieved after launch failure but subsequent stall, undershoot, overshoot, heavy landing, or collision.	<ul style="list-style-type: none"> Plan provisional circuit options before taking off. 	<ul style="list-style-type: none"> If instructing, and P2 makes a mistake, take over early.

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BGA Safety Initiative, February 2010 - Any queries or questions should be referred to safetyinitiative@gliding.co.uk or to the BGA office in Leicester

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