WINCH OPERATORS’ NOTES

APRIL 2017 Rev 2 including Dyneema Cable Repairs
1. INTRODUCTION
These Notes have been prepared for the guidance of winch drivers at Bicester Gliding Centre. They also provide a framework for training and authorising winch drivers, and act as an aide-memoir on basic safety and operating matters. They are based closely on the BGA Winch Operators Manual (Revised Edition dated Oct 2002), Copy held in club office.

2. SAFETY
There are serious safety considerations at all times and with all aspects of winch driving. A powerful engine combined with fast moving cables poses significant potential threats to safety. These risks apply to any activity in the vicinity of the winch and its cables; they extend from the winch itself to the launch point and glider, and include cable towing and retrieve operations. **Winches are dangerous** so cautious, deliberate action at all times is essential.

3. DAILY INSPECTIONS
BGA Operational Regulations require a thorough daily inspection and servicing (D I) of the winch, cables and their attachments, and its prime mover. Details of the checks to be carried out are contained in Annex A, and an abridged checklist is displayed on the winch itself. The winch DI Log Book is to be completed and signed when these checks have been carried out.

4. SET UP OF THE WINCH
The Duty Instructor will decide the runway to be used and the positioning of the winch for the day’s operations. On arrival at the winch location, take the following actions:

- Align the winch to the launch point as per winch position document.
- Apply brakes to prime mover/tractor and engage first gear (the tractor is normally left attached to the winch as an additional anchor).
- Securely position chocks and/or stabilizing legs.
- Push earthing stake into the ground.
- Connect/switch on any communications, radio, lights, and test functioning.
- Start and warm up winch engine.

4.1. Obtain the Duty Instructor’s permission for cable(s) to be towed to the launch point. The cables are to be left at the winch until required.

5. COMMUNICATIONS
The standard system of communicating between the winch, launch point, and retrieve vehicle(s) comprises:

- Twin signaling lamps mounted on the launch point bus, which allow for double cable operation, and which are used by the Duty Instructor to give glider launch instructions to the winch driver (see below).
- A single lamp on the winch to allow a ‘STOP’ light to be shown. If stop lamp is shown, retrieve vehicle goes to the winch for instructions.
- Management Radio sets on a common frequency held at the launch point, winch, and by each retrieve driver.

5.1. Before starting operations, the winch driver should carry out checks to confirm that all lights are clearly visible (the bus lights may need realignment) and that there is good radio contact with both the launch point and retrieve driver(s).
5.2. **Light Signals**

The standard light signals are:
- A steady ‘ON’ light means ‘STOP’. All winch launching or retrieve activity is to cease until the problem has been identified and cleared. Resumption of activity is normally confirmed by radio, and then cancellation of the stop signal.
- A SLOW FLASHING light. Flashes lasting about ½ second at 2 second intervals mean ‘TAKE UP SLACK’ until the cable is fully tensioned and slack removed for either a glider launch.
- A RAPID FLASHING light. These much faster flashes, ½ second ON and ½ second OFF, mean ‘ALL OUT’ and give clearance for full power to launch a glider.

5.3. **Radio Messages**

The Duty Instructor may use the Radio to confirm visual signals in certain conditions, e.g. if there is very bright sunlight, or dazzle from the launch point.

6. **CABLE RETRIEVING**

Cable retrieving procedures to be followed are described in the Bicester Gliding Centre Cable Retrieve Manual.

7. **GLIDER LAUNCH PROCEDURES**

The object of the launch is to accelerate the glider smoothly and rapidly to its optimum launch airspeed whilst avoiding any snatching, and then gradually to adjust the power to maintain an optimum speed throughout the climb. If there is any jerk or hesitation in power at the commencement of the launch, the winch driver must terminate the launch and await a fresh set of instructions from the launch point.

7.1. **Method**

This is generic procedure for WIZ winch (check Skylaunch manual for Skylaunch Operation):
- Ensure that the engine is warmed up to its normal operating temperature.
- Await advice from the Duty Instructor on which cable is to be used, and the type of glider to be launched.
- Check visually that there are no loops or slack at the winch, and that the cable has a clear feed to the drum.
- On receipt of the signal ‘TAKE UP SLACK’, put appropriate drum in gear and positively check that the other drum is out of gear, engage drive, release the brake, and allow the winch idling revs slowly to take up slack in the cable.
- On receipt of the ‘ALL OUT’ signal, open the throttle smoothly and progressively over a count of 2 to 3 seconds to the power setting appropriate to the glider type and wind strength.
- Maintain this power setting until the glider is established in its climb and then adjust power to achieve a steady climb. Indications can be obtained from a general impression of speed, rate of climb, and the degree of bow in the cable. As the climb continues, progressively reduce power to avoid overspeeding/overloading the glider. If the pilot finds the launch is too fast, he will signal the winch to slow down by yawing the glider repeatedly from side to side by using the rudder. On seeing this signal, reduce power until the signal ceases.
- As the glider approaches the top of the launch, close the throttle rapidly and fully in time to ensure that the launch is terminated before the cable reaches the vertical. (This is especially important in light, or no-wind, conditions when there is a danger of the cable dropping on the winch, or beyond the airfield boundary, if the glider delays releasing).
• Immediately the cable is released, smoothly increase power until the parachute deploys, and then maintain a light tension in the cable until the parachute touches the ground. This helps to avoid loops and achieve a clean wrap on the drum.
• If the Duty Instructor has approved mid-field retrieves and when the parachute is on the ground, wind in cable briefly until the parachute is seen to move. This ensures that all slack is taken up before the cable is attached to the retrieve vehicle. When cross-wind conditions exist, it may be possible to ‘mid-field’ retrieve only the downwind cable. If the upwind cable drifts across, it should be recovered carefully to near the winch (see below) and then uncrossed/pulled clear by hand.
• To recover cables to the winch, adjust power to ‘fly’ the parachute clear of the ground and back to the winch. Power must be cut to idle when the parachute is still at a safe distance from the winch (approx. 100 metres) and the final stage of recovery made slowly and carefully. Be ready to disengage drive and apply the drum brake. If cable attachments are pulled through the rollers, considerable damage and delay will be caused.
• When the cable is at rest, put the drum out of gear. Apply the drum tow-out brake ready for cable retrieve to the launch point.
• If gliders are soaring or the launch rate is slow, the winch engine should be switched off to save fuel; allow the engine to cool down at idle for 2 minutes after completing a launch, before switching off.
• On completion of the retrieve, check cable(s) visually at the winch to ensure that no loops or over-runs exist. If slack cable is found, switch off engine and pull out slack/loops forward of rollers.

8. EMERGENCY PROCEDURES
In certain circumstances, immediate action by the winch driver may be essential to ensure the safety of a glider and its crew, or of other people on the airfield. Emergencies can be considered under the following four categories, which are described below, with advice on the actions required by the winch driver:
• Launch failures, including simulated/practice launch failures.
• Failure of the glider to release on completion of the launch.
• Obstruction of the launch.
• Winch power failure.

8.1 Launch Failures
Provided the cable DI is completed correctly, the majority of launch failures will normally result from a weak link breaking. However, other possibilities are that the cable itself has broken, a cable join has failed, a practice cable break exercise is taking place, or a pilot has chosen to abandon the launch. The winch driver may not be immediately certain as to the actual cause. It is good practice for the launch point to warn the winch driver by radio if a simulated cable break is planned.

8.1.1. The first action is to gently reduce the power (rapid reduction of the power will almost certainly result in an over-run and loops on the winch drum) to bring the cable to rest and avoid conflict between the glider and a moving cable or parachute assembly. As soon as power has been cut, disengage the drive and apply brake to prevent drum momentum continuing to wind in the cable. Disengage the drum gear.

8.1.2. It is crucial to safety that no attempt to wind in, or retrieve, the cable should be made until the cause of the launch failure has been positively identified and it is safe to move the
cable. Subsequent actions will depend on the cause of the launch failure and the location of any break in the cable.

8.1.3. If either a real, or a practice, cable break has taken place, the glider may land close to, or on the cable after completing its recovery manoeuvre. No movement of the cable should take place until the glider is seen to be well clear, and good practice would normally require this to be confirmed by radio with the launch point. If the cable has broken, the retrieve vehicle should be briefed to find the broken end (normally by tracking back from the parachute along the wire towards the winch) and tow it back to the winch for repair. Meanwhile, the winch driver should cautiously wind in the broken but ‘live’ end of the cable. Section 11 details cable repair methods.

8.1.4. If a weak link has failed, the retrieve vehicle should be briefed to recover the separated strop and retrieve the cable to the launch point for repair.

8.2. Failure of Glider to Release the Cable
Provided the throttle has been closed to terminate the launch at the appropriate point, and if the pilot does not release, the cable should normally back-release before it is carried to the vertical position. If the glider flies beyond the winch with the cable still attached, the winch driver must always be alert to the possibility (thankfully very rare) that the pilot is unable to release. In this situation, it is not possible to define exactly the point at which the cable should be guillotined, but if the glider passes significantly behind the winch, or starts to turn with the cable still attached, or if the cable angle at the pay-on rollers exceeds the vertical, the winch driver is to:
- Operate the appropriate guillotine
- Apply drum brake
- Disengage the drive and drum gear
- Stop engine
- Use radio to inform launch point that cable has been severed

As a last resort, and only if the guillotine fails, the winch driver can consider using the cable cutter (normally used for cable repairs) to sever the cable.

8.3. Obstructed Launch
If there is any reason to believe that a launch is, or may be, obstructed by people, aircraft, vehicles, or animals, the launch should immediately be stopped. The STOP light should be switched on and no further cable movements made until confirmation is obtained from the launch point that it is clear to proceed.

8.4. Winch Power Failure
If any loss of power is experienced during a launch, the Duty Instructor is to be informed and the cause investigated before a further launch is attempted.

8.5. Safety Reminders
The winch driver must be alert to any activity near to, or behind the winch. There is a special danger of cable brakes causing a ‘whiplash’ effect. If a cable brakes under load, tension is released and it contracts instantly, causing it to move faster towards the winch than the speed at which it was being wound in.

8.5.1. This effect develops very rapidly – particularly if the break occurs close to the winch – and can cause the cable to ‘whip’ at high speed behind the winch for at least 20 – 30 meters.
8.5.2. Winch drivers should ensure that retrieve vehicles wait well to one side – at least 30 meters – of the winch to launch point axis, and that no vehicles are parked, or people are passing/standing behind the winch during a launch.

8.6. Safety Note
A stationary or free-falling cable does little damage: a cable moving under power is potentially lethal.

9. CLOSEDOWN PROCEDURES
On completion of flying, carry out the following actions:
- Wind in cable(s)
- Disengage drive and drum gear
- Switch off engine
- Wind in all remaining slack by turning the drums by hand. Stow parachutes.
- Secure free end of cables
- Apply drum brakes
- Stow chocks/stabilizing legs/earthing spike
- Switch off radio/accessories. Return radio to duty instructor for recharging.
- Refuel winch before garaging it
- Enter any defects in DI/Log Book

10. DAILY INSPECTIONS.
Before the first launch of the day, all winches and prime movers are to be given daily maintenance in accordance with the following schedule:

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<th>Item</th>
<th>Action</th>
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<tr>
<td>Fuels</td>
<td>Check contents are sufficient for the day’s operation. Replenish as necessary.</td>
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<td>Coolant</td>
<td>Check coolant level. No obvious leaks.</td>
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<tr>
<td>Oils</td>
<td>Check levels in engine. Only add oil if on low level mark and add 1 litre of the correct oil Check for oil leaks from engine(s), transmission, drums, pay-on gear and brakes. If oil leaks found seek advice.</td>
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<tr>
<td>Brakes</td>
<td>Check operation and brake fluid level</td>
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<td>Fan Belts</td>
<td>Check for tension and any excessive wear or fraying.</td>
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<td>Tyres</td>
<td>Visual Check</td>
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<td>Warning Lights and beacons</td>
<td>Check lights and gauges for correct indication and function. Obtain a winch radio as necessary.</td>
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<tr>
<td>Prime mover and winch cab</td>
<td>Check clear of broken cable and debris. All controls accessible and free.</td>
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<tr>
<td>Pay-on gear, all rollers and pulleys Guillotine</td>
<td>Check serviceability and freedom of movement. Check mechanism clear of debris which could impede operation. Visual check only – seek specialist help if unsure. Do not touch mechanism or operating levers.</td>
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<tr>
<td>Strop and parachute assembly</td>
<td>Check correct configuration and serviceability of linked rings, launch strops, quick-release couplings, weak links (black, red and</td>
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Cable repair equipment: Check that a cable cutter, hydraulic press and sufficient spare cleats are available on WIZ winch for repair of cable breaks.

Safety Check: Check presence and serviceability of:
- Guards
- Fire extinguisher(s)
- First Aid kit
- Earth Stake
- Wheel chocks
- Communication equipment (e.g., light, radio).

DI Book: Complete and record any defects (a glider DI book is adequate for this purpose).

11. CABLE REPAIR

11.1. Dymeema Cable Repair - See Appendix A

11.2. For Steel Cable repairs (Old Wiz)

Cable repairs must be carried out at the winch, using the cleats/ferrules and hydraulic press provided.

**Safety.** Before any repair to a cable:
- Disengage gear and switch off engine.
- Apply drum brake
- Switch on STOP light.
- Inform Duty Instructor of the action being taken.

**Procedure**
- Clean cut each end of the cable with the cable cutters provided.
- Thread on two ferrules and overlap the cable by about 300 mm (about 12 inches) as shown in the diagram below:

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D = Diameter of cable
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- Place the ferrule (and cable) between the dies, vertically and centrally.
- Operate the hand pump until the automatic pressure valve operates, or if there is no such valve, the swage faces just meet.
- Release the ram and extract the formed swage (a screwdriver may sometimes be needed to ease the swage faces apart).
- Before compressing the second ferrule, for extra security twist the two cables together along the double run between the ferrules. Then secure the second ferrule, as above.
Appendix A, Dyneema Cable Repairs

Introduction

Splicing Dyneema is simple providing you take it a step at a time.

All the tools you need are shown in the picture above. Working from the top we have a *sharp* pair of scissors or you can use a *sharp* knife (it’s surprisingly tough to cut), a large darning needle (this was the prototype, and we now use a shorter one), a “fid” – a pointy tubular tool for threading one rope through another, and some ordinary electrician’s tape.

To cut Dyneema rope, first take a piece of tape long enough to go round the rope at least twice. Wrap it around the point where you wish to cut the rope, and then make the cut in the *middle* of the tape. This will leave you with *two* ends that will not fray.

A couple of definitions:-

The main body of rope you are trying to splice into is called the “*standing part*”. The tail, which you are usually trying to splice in, is called the “*working part*”, or “*working end*”.

The Long Splice

You can see that we have two standing parts, and two working parts. Cut the ends of the standing parts as described above, to sort out any frayed ends. Lay the two standing parts overlapping in such a way that you can tape them together with the two working ends each of length 25cm to 30cm (10” to12”), or about the length of this A4 page. It is not critical, but if you are uncertain, it is better for them to be longer than shorter (by mischance the darning needles are just over 23cm long, it would have been nice if they had been made exactly the right length as a gauge!).
To use the fid, always open up the rope by compressing it gently along its axis, and insert the fid between the strands, adjacent to the tape, and not through the strands. Admittedly, this is the fiddliest thing you have to do, but it makes a much better job from a neatness and strength point of view. If you have done it properly, the fid requires very little force.

Next thread the respective working end into the tubular fid, and then pull the fid fully through the standing part.

This will leave the loop of the working part neatly threaded through the standing part.

Now pull the working end until the loop has disappeared, and the first tuck of the splice is complete. The next step is a fiddly one. When you open up the rope by pushing along its axis you can see little
holes where the strands open up. Skip two holes, from the exit point of the first tuck, and push the fid into the third hole at an angle of about 45 degrees, as in the picture. This means that it should come out at the fourth hole on the under side. That’s the fiddly bit.

Now insert the working end in the fid,

and proceed as in the previous tuck.
To complete the splice you need to bury the working end completely inside the tubular braid of which the rope is made. To do this take the darning needle and open up the strands as you did with the fid, but instead of coming out of the other side of the rope, you push it up inside the rope.

Start where the last tuck came out and skip four holes between strands, and go into the fifth hole at an angle so that the point of the needle is facing along the standing part away from the last tuck. You can now gently thread the braid onto the needle, if you think you have snagged a thread or slipped out of the side, stop, withdraw the needle until you are clear, and then proceed until you have buried about three quarters of its length inside the rope.

Push the needle out through the nearest hole in the braid. Thread the working end through the eye of the needle. With a bit of a struggle at the start, draw the needle and working end through the braid. The tape dimly visible in the top left of the picture was a misleading attempt to show where to bring the point of the needle out. There is no need for it! (Version 2 of the manual will correct this.)

Remove the working end from the needle, and do not let it disappear inside the braid. Carefully pull through the braid to remove the loop visible in the lower right of the picture, but do not smooth out the expanded braid. As before ignore the misleading piece of tape at the left of the picture.
Remove the tape from the working end. Now taper the working end over a distance of a couple of inches, (5cm) by pulling out strands at differing lengths, and cutting them off.

Now ease the braid smooth over the working end, which should disappear into the inside of the tube. Again, ignore the misleading piece of tape.
You have completed half of the splice, now do the other end, starting all over again from picture 02.

The lower spliced rope shows the effect of not tapering the working end prior to burying it inside the rope. There is a sharp change in diameter, which can weaken the splice. This is absent from the top rope, which has been tapered properly. These ropes and splices are exactly the same diameter but the apparent difference is down to the camera angle. A well made and tapered splice has a strength of between 95% and 100% of the full strength of the rope, so it is well worth the effort to do it nicely.

The Eye Splice

The eye splice is started in a different way to the long splice, but the finishing off is identical. Insert the fid at a point to give a working end of length 25cm to 30cm (10” to 12”), or about the length of this A4 page. It is not critical, but if you are uncertain, it is better for them to be longer than shorter (by mischance the darning needles are just over 23cm long, it would have been nice if they had been made exactly the right length as a gauge!).
Take hold of the standing part about 15cm (6”) from the insertion point of the fid.

Fold it back on itself, and after a bit of squeezing and moulding it in your fingers, insert the fold into the end of the fid. Pull the fid, and the folded bit of the standing part through the hole in the working end. It looks a little odd, but if you pull through, you will create an eye, into which you may or may not decide to put an eyelet, depending on the application.

The remaining kink can now be smoothed out, by pulling the working end, and its continuation in the eye. Smooth the kink out, with your fingers, until it looks like a normal splicing hole. You will now have a simple eye with a normal looking standing part and working part.
Tighten the eye around the eyelet, or adjust the size of the eye to your requirements. This picture shows the standing part at the top, and the working part at the bottom. The benefit of this technique of creating an eye, is that it will tend to tighten under load, but the conventional method of inserting a working part into the standing part will tend to undo under load.

You should now insert the fid as in picture 4 of the long splice, i.e. skip two holes and enter the third, and with the fid at approximately 45 degrees to the standing part, exit at the fourth hole along. You end up with this picture 5 matching the state of play in picture 5 of the long splice. Proceed from here exactly as in the long splice instructions, until you have finished.