Adelaide University Gliding Club Inc.

OPERATIONS MANUAL

Part 2: Winch Driving

The winch is a potentially very dangerous machine with risk of bodily injury and death from moving parts or cables. Only properly trained and qualified persons may operate the winch.

Revision	Date	Comment
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This manual is available on-line at
http://www.augc.aus-soaring.on.net/manuals.htm

CONTENTS

Appendices

1.0 AUGC POLICY REGARDING WINCH OPERATIONS

- Two people shall be on the winch whenever possible. This is to ensure that in the event of injury, the other person can render assistance and call for help.

- Only endorsed AUGC winch drivers shall operate the winch.

- Only GFA members shall operate the winch (to ensure insurance cover via the BBL is maintained)

- Visitors and non-winch drivers shall be briefed to keep clear of moving parts and stay in a protected area, cab or well clear on the side of the winch opposite the operating drum.

- Only TOST rings shall be used on the trace.

- Safety Glasses –Any persons not fully protected by the cab should wear safety glasses.

- The winch is not registered and should not be driven on public roads.

- The winch will not be driven at excessive speed or in a reckless manner. Particular care should be taken near people, gliders or other vehicles.

- The winch shall not conduct launches when there are thunderstorms in the area.

- The GFA publication “Winch Launching” can be referenced however it deals mainly with the glider end of the operation. Pertinent issues are repeated in this document.

- The minimum strip length for winch operations is 1200m.

- A suitable weak link shall be installed between the main cable and the trace in accordance with the gliders placard.

2.0 MINIMUM EQUIPMENT

The winch shall not carry out a launch without the following serviceable equipment:

- First aid kit
- Cable cutters, readily accessible
- Fire extinguisher
- Weak links in cable trace

3.0 SAFETY

When approaching the launch point the winch shall slow down to walking pace near aircraft, people or cars. If necessary the winch may back up to the tie down area to avoid nearby aircraft. Particular care should be taken when reversing the winch.

The cables can fray leaving sharp strands, which can easily puncture the skin. The cables should be handled very carefully. Do not run your hand along the cable. Use gloves where necessary.

Safety glasses should be worn during launches by anyone not fully within the cab.

The winch should not be driven with the arms in the up position, as the counterweights will catch the ground.

Witches' hats should be located around the tie down area to warn visitors and the public of the hazardous area.

The moving parts of the winch and the cables could cause serious injury. Keep well away from moving parts, and only work in the drum and cable areas if the engine is off, and there is no chance of the cable being pulled by the launch point crew. Confirm this by positive communication over the CB. Don't assume anything!

4.0 DAILY INSPECTION

The winch driver shall be responsible for ensuring that prior to operation, the winch has had a daily inspection. The following items should be checked:

- Fuel - sufficient for the day's operation
- Coolant - check both engines
- Oil - check both engines
- Drum brakes - check operation and fluid levels
- Poly-carbonate panels - clean
- Cable cutters - serviceable and readily accessible
- Fire extinguishers - charged and serviceable
- First aid kit - readily accessible
- Supply of weak links and swages
- Cable ends (traces) are correctly made up and Day-Glo plastic secured
- TOST rings - inspect for cracks
- CB radio - working and set to correct channel NOTE – the winch CB currently defaults to Channel 1 when turned on – set to Channel 5

Periodically the cables should be walked and worn swages and frays replaced.

5.0 GENERAL

Refer to Appendix A for the correct configuration of the cable trace and the standard cable join / repair, and Appendix B for weak link requirements.

AUGC currently uses galvanized 5mm 7 x 7 steel cables with 5mm aluminum swages used for joins or repairs. Refer to Appendix C for specifications and suppliers.

6.0 TRAINING / QUALIFICATIONS

AUGC Inc. shall nominate an experienced and competent winch driver to be the Chief Winch Instructor (CWI). The CWI is responsible for winch driver training and maintaining winch safety and standards. This person shall report to the instructor's panel, but need not be an instructor.

Trainee winch drivers would generally be solo pilots or well advanced with their training so they have a good understanding of the situation at the glider end of the winch launch.

The training process shall consist of familiarization with this manual and instruction with a Level 2 winch driver on the winch.

When the trainee winch driver is considered competent to drive the winch without supervision, the CWI shall check out the trainee with particular emphasis on safety and emergency procedures, and if satisfied shall endorse their logbook appropriately.

Initially a winch driver shall be rated Level 1. Level 1 winch drivers shall not instruct trainee winch drivers.

After a period of time to gain experience the CWI may upgrade a Level 1 winch driver to Level 2.

Level 2 winch drivers may instruct trainee winch drivers on behalf of the CWI.

7.0 LAYING CABLES

If the winch is used for a paddock retrieve, only one cable shall be laid to prevent any risk the aircraft overrunning the second cable during launch. Otherwise two cables are normally laid.

- Use only a single strand of cable to secure the cable ends to the tie down pegs.
- Ensure the drum brake is engaged so as to prevent cable overruns.
- Ensure the drum selector is in neutral.
- The winch is accelerated gently to no faster than 40 km/hour. The winch driver should avoid following the same tracks however do not move any significant

distance out onto the strip over the first 200m. The truck is then moved progressively towards the centerline of the strip by the time it reaches the other end.

- WARNING – if the winch is moved too quickly to the centerline, the second cable may get dragged over the first, causing a tangle. Also a glider launching on the first cable may pass over the second cable while still on ground run. This entails significant risk of tailskid or other aircraft component hooking up on the second cable.

- Decelerate slowly at the other end to avoid cable overruns. Sometimes the length of cable on the drum is less than the available distance so be careful to stop before running out of cable.

- Listen out for “STOP STOP STOP” over the CB.

8.0 LAUNCH SIGNALS

There are various ways of the launch point communicating with the winch. In order of preference these are CB radio, wing signals, and headlamp signals.
The CB and headlamp signals require at least two ground crew to launch the glider. In the event the CB radio is not working, or there is insufficient crew at the launch point to operate the radio then wing signals may be used. Car headlamps would be used in lieu of wing signals if the winch driver cannot safely observe the glider. Refer to Table 1.

It is important that whatever form of communication is used it must be clear and unambiguous. The winch driver shall not proceed with a launch if there is any doubt.

TABLE 1 – Launch Signals

	CB RADIO	WING SIGNALS	HEADLAMP SIGNALS
Take up Slack	“<Aircraft> on line, <optional information> Take up Slack, Take up Slack Take up Slack”	Rock wings	Slow Flashing
All Out	“All Out All Out All Out”	Hold Wings Level	Fast Flashing
Stop	“ STOP STOP STOP”	Wing down	Continuous On

Aircraft may be referred to by registration or type.

Optional Information may include “carrying water ballast” or “simulated break”

9.0 LAUNCH

The drum selector should only be operated when the engine is off to prevent damage to the half shaft splines.

The cable nearest the centerline of the strip is ***ALWAYS*** launched first. Verify you have the correct drum engaged.

Ensure the engine is warmed up prior to commencing a launch.

Launch radio calls are made three times to avoid inadvertent launches. The call should identify the glider, as well as any additional useful information– such as if water ballast is carried.

Upon receipt of the three “Take Up Slack” calls, the transmission can be put in Drive and the drums will begin to remove the slack fro the cable. No throttle or brake should be necessary. You should observe the gliders wings are level.

UNDER NO CIRCUMSTANCES should you begin reeling in cable without positive instruction over the CB. If there is any doubt do not proceed with the launch and request clarification over the CB. Sometimes other CB users in the area have made prank radio calls. If in any doubt about the authenticity of the caller, radio for confirmation.

Upon receipt of the three “All Out” calls, the throttle should be firmly opened to accelerate the glider. No delay is necessary, but wait until the third call.

The amount of throttle required would depend on the type of aircraft being launched, if it has water ballast, and the head wind component. Remember a 15-knot due cross wind has no head wind component so the launch power required will be essentially the same as that of a still day.
It is important to accelerate the glider to its best climb speed as quickly as possible. Slow ground runs are dangerous. A glider with airspeed has plenty of options available to it, whereas a slow launch can pull the glider into the non-maneuvering area or leave it at the mercy of a cross wind.

Usually the throttle is applied firmly to get the glider airborne and then backed off slightly as the glider pulls up into full climb.

This requires some cooperation from the glider pilot; if, given safe airspeed, he does not pull up into full climb quickly enough the glider can exceed its maximum winch speed.

Remember on a windy day, wind shear will have the glider climbing up into a faster air mass, adding to its indicated airspeed. On days like this the winch driver has to be quick reducing the power after the initial acceleration.

The ideal launch would see a constant cable tension applied to the glider from “All Out” to top of launch. This would allow the glider pilot to climb at an angle that provided the best indicated airspeed for that aircraft (say 50 knots or so). Engine rpm and cable speed do not have a consistent relationship with indicated airspeed and therefore cannot be used as a guide.

The bow or sag in a cable suspended between two points is directly proportional to the tension in the cable, independent of the weight of the glider, the speed of the cable or glider. On windy days however you will see more sag than on calm days due to the additional wind drag on the cable.

Otherwise this technique provides a ready way of judging the tension in the cable, and therefore glider indicated airspeed. Obviously this only works once the entire length of cable is clear the ground, but otherwise maintaining a constant sag in the cable will ensure constant glider indicated airspeed.

10.0 SPEED SIGNALS

The glider pilot will signal too fast or too slow as required to maintain his indicated airspeed.

TOO FAST – the glider pilot will yaw the glider. It is not necessary to lower the nose of the glider prior to giving a too fast signal, as this only causes the airspeed to increase further.

TOO SLOW – the glider pilot will roll the glider. As the glider is slow the pilot should have the nose down – an observant winch driver may notice the nose being lowered as a prelude to a slow signal.

In either case the winch driver should adjust the power accordingly.

Observation of the sag in the cable should allow the winch driver to keep the indicated airspeed constant throughout the launch and thus be lavished with praise and kind words from the pilot.

11.0 TOP OF LAUNCH

As the glider approaches the top of launch, the power will need to be steadily reduced (although the tension in the cable will remain reasonably constant).

Generally the winch driver decides when it is time for the glider to release, so as to prevent miles of cable being dropped on him, particularly on still days. At this point the winch driver backs the power right off, and the glider pilot should lower the nose and release the cable. Back the power off quickly so the pilot recognizes the change.

12.0 HOOK UPS

If the glider release fails to operate and the back release jams, or the cable is caught on some other part of the glider, then this is referred to as a *HOOK UP*

Potentially very dangerous, both the pilot and the winch driver have to respond quickly.

The glider pilot should immediate commence a descending turn directly over the winch.

The winch driver has to stop the engine, engage the drum brake, grab the cable cutters and – provided he doesn't risk the cable falling on him – cut the cable and jump back in the cab. The cable should be approached from the opposite side to the direction in which it is leaning. This will ensure it will fall away from the operator when it is cut. It may pay to wait a moment while the glider tows it into an appropriate direction.

Remembering there is no radio communication between the winch and the glider (CB / VHF). The glider pilot will continue turning and descending until he needs to level out and land.

13.0 POWER LINES

If there is any chance that the glider will drop a cable on the power lines (66,000V) then the winch driver should sit tight on the winch and cover the eyes to avoid flash damage. Under no circumstances make any attempt to abandon the vehicle while the cable is still attached to the winch and the power lines. Experience has shown that the stranded cable will probably explosively disintegrate if it connects the power line to earth. Do not go near any remnant cable hanging from the power lines. This should be reported to the power line operators.

Probably grass fires will need to be extinguished following this type of accident.

14.0 RELEASE / REEL IN

When the cable is released from the glider, the initial reeling in should be slow until the arms are in the horizontal position. The reel in should then be sped up to ensure the cable does not end up loose on the drum. Engine speed should be limited to 2000rpm when reeling in cables.

Slow down near the end and take care not to pull the cable end through the heads. Check the effectiveness of the brakes before you need them!

The engine can then be turned off, the other cable drum selected and the launch process repeated as above.

CAUTION – ensure the cable ends are secured to the arms prior to driving back to the launch point, otherwise they can unwind off the drums or worse get caught up in the back wheels of the truck.

15.0 OVER-RUNS

Sometimes the glider overruns the cable during the ground run and releases. The glider is pushed or towed back to the launch point, and then the cable may be dragged back by people or a car, or reeled in by the winch. Either way it is important to communicate with the winch before dragging the cable back. The winch driver may have his arms in the drum sorting out a tangle.

16.0 CABLE BREAKS

Refer to Appendix A for the standard cable join procedure.

Sometimes the instructors will simulate a cable break during the launch by pulling the release. It is preferable that the instructor lets the winch driver know beforehand, but this often not possible.

In the event of a cable break the winch driver should keep his eyes on the trace Day-Glo and note where it falls, then note a landmark immediately behind it. This can reduce the time taken to find the end significantly.

If it is the first cable, and the broken end is well clear, then the cable can be reeled in and another glider launched on the second cable. The truck can then go and find the broken end and make the repair.

If the first cable falls near the second, then it must be retrieved and towed to the winch by a car.

UNDER NO CIRCUMSTANCES SHALL THE LAUNCH CREW RETRIEVE A CABLE WITHOUT CONFIRMATION FROM THE WINCH DRIVER THAT IT IS SAFE TO DO SO.

UNDER NO CIRCUMSTANCES SHALL THE WINCH DRIVER REEL IN A CABLE WITHOUT CONFIRMATION THAT THE GLIDER AND PEOPLE ARE CLEAR OF THE CABLE.

17.0 EFFICIENCIENT WINCH OPERATIONS

People at the launch point always believe the winch driver is dragging his/her feet. The winch driver believes the same is occurring at the launch point. Unfortunately both parties are often right!

The winch crew can substantially increase the launch rate by being organised and ahead of the job. Average AUGC launch rate is usually around 4 launches/hour provided no big foul ups occur. With organisation 6 launches/hour is easy to achieve. Club record is 13 launches in an hour with one winch (That gets the launch point crew working!).

The things which cannot be sped up are the actual launch, the cable lay time and the return driving time. These productive elements of the process don't contribute a great percentage of the total launch cycle.

The following will contribute to efficient winch launching:-

- Work as an organised team - 1 person basically operates the winch, 1 the truck.

- As the truck comes to a halt the winch operator should let the launch point know that the winch is ready (you will engage the drum / start the engine / release the brake a whole lot quicker than they will pick a cable up and hook a glider on)

- The truck operator should be out of the winch and waiting to wind the cable ends up as soon as each reel in is complete. This saves the winch operator getting out of the cage. Stand clear of the cable until reel in is complete.

- As soon as the last end is wound up the truck operator should jump in and go. The winch operator has plenty of time to sort out the winch ready for the next lay.

- At the launch point the winch operator should stay in the cage and release/engage drum brakes as necessary to ensure smooth hook down of the cable ends.

- The launch crew should hook the cables onto the tie downs, so the winch crew doesn't need to get out, thus wasting time.

- If a cable fray is observed during cable reel in it is usually easier to repair it during the next lay. If this is planned and managed well by a dual winch crew the launch point crew will hardly notice. The winch operator will need to keep a close eye on the offending cable and yell loud to the driver to stop when the fray lays out. When the truck stops both crew need to get some slack in the cable and get to the repair point as quickly as possible armed with tools and swages (a smart operator always has a couple of spare swages in his/her pocket!). Fixing a fray is far less delaying than chasing after a cable break.

  If a significant tangle occurs, or a break occurs with a hard to find end get on the radio and ask for extra hands / eyes.

Fundamental to efficient operations is good communications between the winch crew and the launch point crew. This requires the following:

- Reliable CB communications

- A winch crew that keeps the launch point informed of winch status.

- A launch point crew that keeps the winch informed regarding pending launches

18.0 REPLACING / ADDING NEW CABLE TO THE DRUMS

When the cables are walked defective cable should be removed wherever it is found along the length of the cable. The greatest load and wear occurs on the cable at the glider end.

When additional cable is required to be added to a drum it should be added at the outer (glider) end.

The cable should be wound onto the winch drum with identical wrap to that it has experienced on the delivery spool. Since the cable is reeled onto the top of the winch drum it should be taken from the top of the delivery spool to achieve this (see diagram below). If cable is wound on in the incorrect direction major problems and tangles will occur early in life and cable life will be considerably shortened.

A full spool of new cable is heavy and should be solidly mounted on a robust spindle during cable transfer to the winch drum. If it gets away during transfer someone is going to get hurt.

New cable will sit much better if wound onto the winch drum under tension. This requires some sort of braking arrangement to be applied to the delivery spool during transfer. A piece of heavy timber held across the spool by 2 people constitutes a reasonable brake for the purpose.

If a large amount of new cable has been added it may pay to launch a single seater first up so that the cable is broken in stages.

Since the cable does not wear evenly it should never be necessary to replace the whole cable provided that it is routinely maintained.

19.0 END OF DAY

The winch battery shall be isolated.

If the fuel bunker is getting low, or cable or swages or any other materials or repairs required, then the winch driver shall make the necessary arrangements otherwise the next days flying may be compromised.

<End>

Appendix A Standard cable trace and joint arrangement

TRACES

The traces fitted to the end of the cable must conform to the standard below:

- Tost rings only to be used
- Minimum 5m of trace cable, sheathed in rubber hose. The hose provides some stiffness to the cable and reduces the chance of the cable catching on the glider.
- A weak link of appropriate rating
- A loop of thin cable (usually a single strand of the 5mm cable) attached to the end of the main cable before the weak link to attach to the tie down points
- A length of orange plastic or similar, attached to the trace end of the weak link, which helps with finding the cable end in the event of a cable break.

Diagram of trace arrangement:

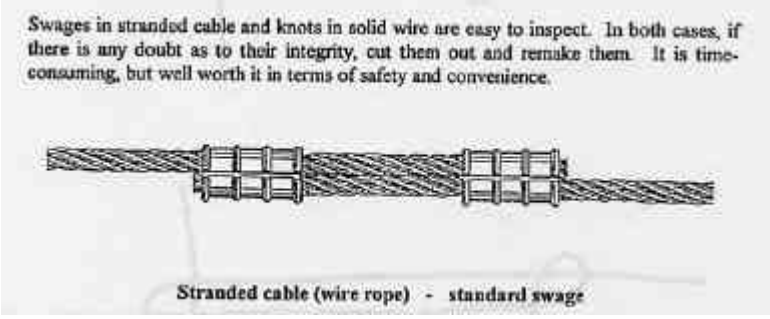
Genuine TOST rings at end of trace:

The cable must be fastened to the LARGE ring only.

CABLE JOINS

When new cable is added, a fray is cut out or a break has to be repaired, a join will be required. Two aluminum swages are used, and clamped on to the cable as indicated in the diagram below. Several mm of cable should protrude from the swages, and the gap between swages should be about 50mm.

Diagram of standard join:



These joins wear with use and eventually have to be replaced.

Appendix B Weak Links

The glider certification assumes a weak link of the correct rating is installed in the cable. The weak link acts like a fuse, breaking if excessive load is applied.

Without a weak link the glider could be overstressed and damaged.

Conversely, a weak link which breaks at too low a load will cause nuisance breaks.

Different aircraft have different requirements:

AIRCRAFT	WINCH RELEASE WEAK LINK Kg
Blanik L13	600 - 800kg
Bergfalke	500kg
Puchatek	677kg
Arrow	450kg
Club Libelle	510kg
Standard Libelle	500kg
Pik 20B, D	500kg
Boomerang	450Kg
DG200	500Kg
Ventus	650Kg

It is required that the appropriate weak link be used for the aircraft being launched. Each aircraft should have the weak link strength placarded near the release.

AUGC Inc. currently uses a smaller diameter cable of tested breaking strength as the weak link.

The weak link consists of a length of cable with a loop swaged each end, about 150mm long.

The club is currently reviewing how it implements weak links in future.

Appendix C Cable, swages, etc. specifications and suppliers

Main Cable:	5mm Galvanized steel cable 7x7
Main Cable join swages:	5mm Aluminum swages
Trace Cable:	5mm Galvanized steel cable 7x7
Trace Hose:	Red Rubber hose
Rings:	Genuine TOST rings available from the GFA Office

The galvanised cable and aluminium swages can be sourced from BHP Lifting Products (Bullivants). Also cutting and swaging tools.

BULLIVANTS

Grand Junction Rd (cnr South Rd) Wingfield 5013 **(08) 8260 4711**

Fax (08) 8260 5610

Internet www.bullivants.com

A variety of cables and copper swages can be sourced from Glascraft Marine:

GLASCRAFT MARINE PTY LTD

Marine Accessories - Skis & Sailboards

247 Pirie St Adelaide 5000 **(08) 8223 3055**

Fax (08) 8223 7517

Email glascraft.sa@adelaide.on.net

Internet www.glascraft.com.au