British Gliding Association

Aerotowing Guidance Notes

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AAN	Airworthiness Approval Note
AD	Airworthiness Directive
AFFF	Aqueous Film Forming Foam
agl	Above Ground Level
AIC	Aeronautical Information Circular
AME	Aero Medical Examiner
AoA	Angle of Attack
BGA	British Gliding Association
CAA	Civil Aviation Authority
CFI	Chief Flying Instructor
CHIRP	Confidential Human Factors Incident Report Procedure
CHT	Carb Heat Temperature
CO_2	Carbon Dioxide
C of A	Certificate of Airworthiness
COSHH	Control of Substances Hazardous to Health
CRI	Class Rating Instructor
CTP	Chief Tug Pilot
DCTP	Deputy Chief Tug Pilot
DI	Daily Inspection
EASA	European Aviation Safety Agency
ETA	Estimated Time of Arrival
FAA	Federal Aviation Administration
FCL	Flight Crew Licensing
FIC	Flight Instructor Course
FIE	Flight Instructor Examiner
ICO	Idle Cut Off
JAA	Joint Aviation Authorities
JAR	Joint Aviation Requirements
LAMS	Light Aircraft Maintenance
Mogas	Motor gasoline
NPPL	National Private Pilots Licence
RIDDOR	Reporting of Injuries, Diseases
RT	Radiotelephony
SEP	Single Engine Piston
SLMG	Self-Launching Motor Glider
SSEA	Simple Single Engine Aircraft
STC	Supplemental Type Certificate
TBO	Time Before Overhaul
TCAS	Traffic Collision Avoidance
TMG	Touring Motor Glider
UHMPTE	Ultra High Molecular Weight Polyethylene
VP	Variable Pitch

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THE BRITISH GLIDING ASSOCIATION

The BGA is the national authority for sporting gliding in the United Kingdom under delegation from the Royal Aero Club which in turn is a member of the Federation Aeronautique Internationale (FAI). The BGA operates through an elected Executive Committee, specialist sub-committees and a small professional staff.

PREFACE AND USE OF THIS DOCUMENT

These notes have been compiled in the interest of safety, using the established practices of a number of gliding clubs and the experience of very skilled aerotow (tug) pilots, and are offered to club tugmasters and tug pilots as a source of guidance and known good practice.

The author has drawn freely on good practice guidelines developed over many years by the gliding community. Much of the content has previously been published, in one form or another, by individuals and clubs and the author acknowledges the work done by others that has helped so much in the preparation of this document. There are too many examples to acknowledge individually.

The BGA accepts no responsibility for any of the suggested practices contained in this document. Aerotowing (tugging) is subject to the Air Navigation Order and other aviation law.

The notes are intended as a general guide to glider tugging operations. Each club has its operating environment and problems and should adapt these suggestions to suit their own needs.

Each tug pilot should carry a degree of responsibility. Aerotowing is potentially expensive, can create noise and has hazards associated with it. These factors have a bearing on the very existence of gliding and it is therefore essential that aerotowing be carried out safely, efficiently and thoughtfully, paying particular regard to our neighbours.

Aerotowing should be carried out in accordance with British Gliding Association (BGA) and Civil Aviation Authority (CAA) procedures and in conjunction with club flying rules. Pilots in command of aircraft are ultimately responsible for the safe conduct of the flight and the actions that they choose to take. Within these constraints the glider pilot's requirements should of course be accommodated as far as possible.

Inclusions and alterations made in future editions will be marked ●

Gender: All references in the text to "he/him/his" shall mean "she/her/hers" where applicable.

PART 1
AEROTOWING OPERATIONS

1 THE PURPOSE OF GLIDER TUGGING

The tugging operation exists of course to provide launches to gliders. Thus waiting time should be minimised and the launch needs of the glider pilot met. For example, solo soaring pilots may require you to drop them in the nearest lift source, whilst students may need to remain near the field with gentle manoeuvres.

Another important point is to minimise cost to the club, by conserving the engine by careful handling and reducing fuel burn by accurate aircraft handling and by minimising ground running.

In short the three main points that a tug pilot should always aim to achieve are:

- **SAFETY** – Safe flying and good airmanship is expected at all times and is everyone's responsibility.
- **ACCURACY** – Delivering the best service to the glider pilot.
- **EFFICIENCY** – Handling the engine with precision; fuel economisation with quick and efficient turnarounds

2 CHIEF TUG PILOT (CTP) OR TUG MASTER, CLASS RATING INSTRUCTORS (CRIS) AND FLYING INSTRUCTORS (FIS)

The Chief Tug Pilot or tug-master is, in conjunction with the club Chief Flying Instructor (CFI), responsible for the towing operations at that club. This includes checking and training of tug pilots, making up tow ropes, maintenance, rostering of pilots and airworthiness of tug aircraft. The Chief Tug Pilot (CTP) could have a Deputy Chief Tug Pilot (DCTP) for assistance and to stand in when required. Bi-annual (every two years) training flights, as required by British law, can be flown with a Class Rating Instructor (CRI) or Flying Instructor (FI). If a tug pilot inadvertently lets his certificate of experience expire, this can be renewed by flying a skills test with an examiner. Confirm this with BGA as this can sometimes be arranged in-house thereby reducing cost considerably. At the time of writing, BGA Senior Tug Pilot, John Marriott, is an examiner and will renew any expired rating at Bicester free of charge, except for the aircraft rent.

3 ROLE OF THE TUGMASTER OR CHIEF TUG PILOT

The tugmaster is responsible for safe and efficient operations. He or she should be as knowledgeable as possible about gliding and light aircraft operations and should ideally have a seat on, or access to, the club's management committee. Advice for tugmasters and, indeed, tug pilots is readily available from the BGA, CAA and BGA chief tug pilot. Some large and established gliding clubs have particularly experienced tug masters and would be pleased to pass on advice or help in any way. Any pilots or club officials are encouraged to ask for advice or simply exchange ideas, especially anything safety related.

4 APPROVAL TO FLY TUG AIRCRAFT

So long as it is not done for hire or reward, (see CAA exemption to allow "Private Aircraft" - http://www.caa.co.uk/docs/33/ORS4_584.pdf) there are no formal qualifications and no minimum experience as such for being a club tug pilot; this is left to the discretion of the club tug master who may, of course, revoke or suspend any tug pilot's approval for any reason he or she feels is reasonable. It is preferred that tug pilots are and remain current as glider pilots, or better still, instructors. It is the pilot's own responsibility to maintain a current licence, ratings and medical; a list of the validity of these licenses and medicals could be held by the club to help ensure validity. Aero Medical Examiners (AMEs) are listed on the Civil Aviation Authority (CAA) website. Please keep you certificate of experience valid or an expensive renewal test might be required. Employed tug pilots may be subject to professional licensing requirements.

A pilot with previous towing experience should normally have satisfactorily completed a proficiency flight with the club tug master or deputy before flying tug aircraft at a new club or on a new type. New tug pilots should normally receive type conversion followed by tugging instruction as described later in these notes.

5 LICENCES AND MEMBERSHIP

In the UK, each tug pilot should normally be a full flying member of the Gliding Club and hold a valid pilot's licence, which should include the following:

- **A valid licence.** You are reminded that a JAR issued licence is valid for 5 years; a NPPL is valid for life.
- **A valid medical certificate.** You are again reminded that the validity of the medical certificate varies between licence types and at different ages. Your medical can be renewed up to 45 days early with no penalty.
- **A valid Certificate of Experience**. The Certificate of Experience is valid for 24 months for a JAR licence and a rolling 12 months for a National Private Pilots Licence (NPPL).

The certificate of revalidation contained in the licence must be signed and be current for "SE Piston (land)" aircraft or Simple Single Engine Aircraft (SSEA) for NPPL licences. A JAA Examiner may sign the FCL 150, once he/she is satisfied those 12 hours have been completed on any SEP aircraft during the preceding 12 months (JAR). The 6 hours in the preceding 12 months (NPPL) do not require a signature as long as the rating is kept valid. You must also have completed at least 1 hour's flying with a Class Rating Instructor (CRI) or Flying Instructor (FI) in the preceding 12 months before revalidation. (Professional pilots completing simulator training are exempt the training flight). The certificate can be signed up to 3 months early without penalty. It is also a requirement to have completed 12 take-offs and landings within the preceding 12 months, this should not prove to be a problem for most tug pilots! The instructional flight is essentially a general handling and aero-tow refresher and not to be considered as a test. The instructor can include anything he or she considers might benefit that pilot. These requirements are subject to change and pilots are requested to refer to the CAA's excellent LASORs publication, which can be found on the CAA website or purchased in hard form.

It is also suggested that tug pilots check that they have liability insurance and that glider and light aircraft flying does not impose limitations of life and disability insurance cover.

6 RECENCY AND CHECKS

This is at the discretion of the club tugmaster and can also depend on that individual's experience but things must remain within the law. Anyone who has not flown within a reasonable period of time should fly a refresher trip in that aircraft before towing. This should be done with the tug master, his deputy or qualified instructor if possible. Please note that 3 landings within 90 days are JAR requirements to carry passengers.

It is suggested that each tug pilot should occasionally have an instructional flight with the club tug pilot or nominated deputy to include normal tows, general handling and emergency drills. The flight should be viewed as an opportunity to brush up on flying skills and practice unusual situations – it is not viewed a test but a reasonable standard of operation should be expected.

7 NOISE ABATEMENT PROCEDURES AND AWARENESS

Tug pilots must be aware of the possibility of noise complaints at all times. Airmanship and common sense dictates that we should avoid towns, villages and farms by the widest margins. Flying downwind of noise-sensitive areas will help reduce noise effects.

Continual towing or descent over the same area may cause considerable nuisance and irritation to our neighbours. Some tugs have already been modified to minimise the actual noise produced. However, we can also spread the load by thoughtful and varied tow-out patterns. Variation therefore should help form the basis for noise abatement procedures.

When towing, the following general points should be considered:

a) Make full use of all airspace available to you.

b) It is not always necessary to drop upwind; a tow made for the most part downwind of the site and then terminating overhead or slightly upwind of the site can also be used.

c) Remember that when turning, the focal point of your turn (the lower wing will be pointing at it) will be subjected to a concentration of tug noise, adjusted by wind

d) Noise drifts downwind

e) A soaring pilot may be happy to be towed directly away from the site; this should be done when the opportunity arises.

Remember that the noise of a descending tug with a relatively high power setting can be equally annoying so apply the same techniques and practices in descent as well. Also, try and make your descent route different from the tow-out route. It is a good idea therefore to not descend too low until entering the circuit area to assist in reducing noise to our nearest neighbours.

Consider circuit heights that could be lower than glider circuits for low wing aircraft such as the Pawnee or Robin and higher than glider circuits for high wing aircraft such as the Super Cub so as to enable a good lookout.

8 AUTHORISATION AND RESPONSIBILITIES

As licence holders, tug pilots have a personal responsibility to ensure that their licence, ratings and medical certificate remain valid. At some clubs the tug-master proactively keeps an eye on this, but it is becoming increasingly difficult for one person to ensure many tug pilots have everything kept up to date.

Most tug pilots are self-authorising for aerotowing but it is a legal requirement that all powered aircraft movements are recorded. A movement or aerotowing log is suggested. All aero-tow retrieves, positioning flights or hire flights should be entered. Particular attention should be paid to overdue procedures and the reporting of any defects.

It is the tug pilot's responsibility, after full consultation with the instructor in charge, to terminate aero-tow operations when bad weather or darkness approaches. Do not launch a glider after sunset. Resist all forms of persuasion to launch in these circumstances. Remember, it is dark on the ground when it is still light at altitude! Advise the instructor in charge of this time a little in advance. Avoid towing in areas of thunderstorms due to the hazards associated with them such as:

- Turbulence
- Windshear
- Lightning
- Reduced visibility
- Scare factor!

It is the tug pilot's responsibility to terminate aero-tow operations if conditions are deteriorating or operation is becoming hazardous for any reason. Remember you are P1 for the whole combination until release, however senior the pilot of the glider.

Cables in the air or on the ground are particularly dangerous. Before every take-off it is essential to check that a winch launch is not taking place or about to take place. A radio call is suggested to confirm this with the duty instructor. Delay the launch until the cable is back on the ground. Do not take off across or close to winch cables.

As stated before, recording of towing operations is a legal requirement and is of equal importance to the club treasurer! In many clubs it is the responsibility of the tug pilot to record his tugging. Before take-off note on the tug log card the glider, name of pilot to be charged and the take-off time. Subsequently record the exact aero-tow release height (to the nearest 100ft). These cards are essential for rendering launch charges to Club members and must be legible and accurate. For example a release at 2100ft agl should be recorded as such and not as 2000 feet. However, don't let the paperwork detract from safely operating the aircraft!

Ensure adequate clearance of the towrope from the ground when approaching to land and in general do not over fly people, cables, aircraft or vehicles prior to landing. Leave a minimum of 100ft approaching over crop or any boundary.

Passenger carrying is not normally a good idea whilst aerotowing for performance reasons. Exceptions to this rule should normally have specific authorisation from the club tug master, flying instructor or person of authority. Training flights are obviously required at times, but due consideration must be made with respect to the extra weight of two pilots in the tug, length of grass, wet or dry, weight of glider, etc.

Flights that involve landing away or flights for navigational practice and so on should be booked out after first checking that the aircraft will not be needed for the expected

duration of the exercise. The booking out process informs people where you are going and what you are doing should you not return!

To enhance conspicuity, anti-collision lights, and landing lights where fitted, should be on whenever the aircraft is in flight and also for taxying. Note that double lights in one wing as on some Robin types can overheat and subsequently burn-out, so consideration should be given to using just one light at a time. Manoeuvre as much as possible after glider release, this aids lookout and shows you to other airspace users.

No tug aircraft should take off unless the pilot in command is certain there is sufficient fuel in the tanks for safe operation - if in any doubt, refuel! Fuel starvation is still the most common cause of engine failures in piston singles but it is also the most avoidable. It is imperative that you do not allow yourself to be pressured into carrying out 'just one more tow' when you think you should be refuelling. As always, think ahead. For example, is the next tow a spin training exercise to altitude, necessitating more fuel? Or, there will be a natural break after the next launch so let's use that time to refuel.

During towing operations the electric fuel pump (if fitted) should be on to reduce the chances of engine failure due to failure of the mechanical pump. However, consider taxying out with the electric pump off to verify correct operation of the mechanical pump, but don't forget to turn in on before flight. There are advantages and disadvantages to turning the fuel cock off at the end of flying when the tug is put into the hangar. If the fuel is turned off sooner or later someone will try to take off with it in that position. Risk assessment suggests it is best to simply leave it switched on, however cycle it on and off periodically to exercise the fuel stop valve and check its correct operation by stopping the engine with it occasionally. You might be surprised how long the engine will run with the main cock turned off!

9 JAR TUG CRI TRAINING & RENEWAL

The Class Rating Instructor (CRI) rating is valid for 3 years and signed up by a Flight Instructor Examiner (FIE) on a FCL150 plus instructor CAA Form 3.

Renewed by:

- **Experience** – 10 hours instructing on Single Engine Piston (SEP) aircraft (not SLMG unless instructor holding a TMG rating) in the final year of validity
- **Refresher training** carried out by senior tug pilot examiner if not achieving the 10 hours above
- **Refresher training** with a Flight Instructor Course (FIC) organisation if the rating has expired

Privileges include:

- Instructing on type for which the candidate already holds a licence
- Differences training (if the CRI is experienced on that difference)

The term FI relates to a Flying Instructor.

The one hour instructional flight as required to renew a pilot's certificate of experience is normally signed in the individual's logbook. If the CRI is unhappy with the standard of flying, he should not sign that person's logbook and recommend to them some instructional flying. The BGA can help with this if required. There is no requirement to complete any other paperwork at BGA/CAA level; clubs can of course record

anything at their discretion, but consider the Data Protection Act. The content of the instructional flight is at the CRI/FI's discretion, but should be practical.

Who can teach what? In essence, CRIs can teach the holder of a licence; an FI's rating is required to teach for the issue of a licence.

Simplified authoritative information on all this can be found in the CAA's LASORS, available on-line.

It is the responsibility of the individual to revalidate their CRI rating.

Please note as of mid 2006:
- A CRI rating would cost a new candidate approximately £1,800
- There are only a small number of organisations that provide CRI training.
- A Flying Instructor's course costs £6,000+
- A Flying Instructors test cost £160+

10 HEALTH AND FATIGUE

It might be stating the obvious but ensure that you are fit to fly. If flying under a canopy, wear a hat. If flying for a period of time take a bottle of water to remain hydrated and consider taking a snack. Don't let any of these items become loose articles and jam your controls!

11 ADVANTAGES / DISADVANTAGES OF DIFFERENT TUG TYPES

- **The Pawnee** makes an excellent tug. It possesses the one very important advantage when towing gliders – power! Its main drawbacks are that it is a single seater and cannot be used for training (except from an instructor shouting instructions into a radio on the ground!) Low utilisation could make the maintenance costs unrealistic depending on the mod status of the aircraft. Bi-annual wings off checks are mandatory unless modified and they relatively high fuel consumption.

- **Robins** are often used as tugs. Their advantage is they also make a good touring and therefore syndicate aircraft. Their disadvantages include quite a long take-off run, especially off grass.

- **The Supercub** makes quite a good tug. Its disadvantage is that it is a difficult machine to handle in strong winds, requiring great care when turning downwind!

- **Rallyes** are also often used as tugs. They offer excellent visibility, reasonable performance, their easy handling makes them good training aircraft and all metal construction makes them resilient. On the down side, it is said that they suffer from corrosion, have small wings which means performance suffers with increasing weights, poor instrumentation, over sensitive trimmer, 150/180 versions have poorish climb rate and they are really ugly!

- **Motor gliders** are beginning to appear with glider tow hooks fitted. The Rotax Falke appears to make a quite good towing aircraft, as long as the glider is not too heavy. Rotax engines need careful handling, suffer if using leaded Avgas and have restricted overhaul lives.

- The Chipmunk**/Supermunk** also makes quite a good tug. Its disadvantage is similar to the Supercub in that it is a difficult machine to handle in strong winds,

requiring great care when turning down wind or braking. Chipmunks use Gypsy Major engines - these have a restricted overhaul life, higher maintenance costs, less power and will probably use as much oil as fuel!

- More information is in the Technical and Maintenance section of this document.

12 TAIL-DRAGGER AIRCRAFT

Many tugs are of the tail-wheel type, which requires extra piloting skills. In the UK tail-wheel types are classed as “complex types” and require training by a qualified instructor (FI/CRI). Some tail-wheel information is reproduced here:

- Tail-wheel aircraft are unstable so that a bounce can become oscillatory
- If landing with a slight tail wind the rudder can reverse in effect
- Torque, slipstream and gyroscopic effects are more prominent
- Excess braking with a tailwind can cause tail-draggers to tip on their nose. Taxying downwind requires great care.

13 ALLOCATION OF TUGS

Engineering and performance requirements should be considered when allocating tugs. For example, you might want to use up hours on one particular machine or you might want a tug available for the launching of heavy gliders.

14 DAILY INSPECTION AND DEFECTS

The Duty Tug Pilot or nominated Tug Pilot should conduct a daily inspection (DI) or “check A” the tug. Any defects must be recorded and brought to the attention of the tug master and duty instructor immediately so that they can be rectified at the earliest opportunity and ensure that tug is not used. Make sure any defect clearly identifies an unserviceable aircraft! The tug pilot should also DI the rope, checking for chafing, knots, reduced length due to repairs and the condition of the rings and weak links. Generally, the longer the rope the safer it is for the tug pilot, however in practical terms 180 feet is a reasonable compromise. Unserviceable ropes should be identified and put in a place where they cannot be inadvertently used. Please do not attempt to repair a broken rope or change a broken weak link unless you know what you are doing – take a new rope from your store and report and mark the broken rope. Periodically check the tug release mechanism. It is helpful to have marks on the ground at some convenient place to check rope length. Check the mirror is clean and properly aligned. Clean the canopy and windscreen. See BGA amended LAMS issue 2 Check “A” that can be laminated and kept in the aircraft.

15 PROPELLER SWINGING

Here we come to an extremely dangerous bit - avoid doing it if possible! If the aircraft simply has a flat battery, consider charging it or jump starting the machine. If swinging is carried out it should be done with great caution.

A few general safety precautions could include:

- Always treat a propeller as live
- Ensure the aircraft brakes are set
- Ensure the mixture is at ICO (Idle Cut Off)
- Ensure the mags are off
- Ensure the throttle is closed
- Use chocks
- Ensure that there is a competent person in the cockpit
- Ensure that the area around the propeller is clear of oil, water and anything that could cause you to slip
- Establish clear communications
- Never hand swing an aircraft with a 4 blade propeller

4-blade propellers are lighter as they are made of wood and have less inertia to carry through the compression, usually smaller in diameter so more force is required and the next blade comes around in half the time.

If in doubt – don't!

16 TAXYING

Taxying tail dragger type aircraft requires special care. Normally hold ailerons into wind and hold the stick back, unless taxying in a strong tailwind, where holding the stick forward might be more appropriate. If the tailwind is slight, for example about taxy speed, the relative airflow would be nil, so consider holding the stick fully back so that propeller slipstream helps to keep the tail down to help preventing that dinked propeller. For the same reason cross from hard surface to grass and vice-versa at 45 degrees with the stick fully back, this applies to a tricycle undercarriage aircraft also. Remember that you might be dragging a tow rope – don't forget allow for this especially during turns!

17 RUN-UP

Turn the tug before starting the engine so as to avoid streaming your prop wash into an open hangar, or at nearby parked gliders. Try to park into wind, which aids engine cooling and reduces the chances of flying controls banging around. Normally warm the engine at 1000 to 1200 rpm. Do not go above 1500 rpm until CHT is approaching 100oC. (standard Lycoming figures). During the warm up, check the operation of the magneto switches to ensure they both work. A momentary live/dead check with one switch off and then the other off at the same time will confirm this. Switch the mags on again immediately before the engine slows. Magneto drop off checks are normally done at a higher rpm (check engine operation handbook for speeds and correct drop figures). Once warm, check the carb heat and leave that carb heat on long enough to melt any ice, normally 20 to 30 seconds. After the power check, if there is any doubt that the engine is not developing full power, do not attempt to tow until the problem is rectified. A slight reduction in rpm equals a substantial reduction in power available. (An engine rated at 180hp will only produce about 160hp if you try to take off with a very slightly reduced RPM!)

18 TAKEOFF

Normally move into position by passing across the nose of the glider in order to bring the rope closer to the ground crew when convenient, and try to park at 90o to the glider. This gives you a good view of the glider whilst sending the slipstream clear. Try to have some wind component blowing into the engine for cooling purposes if you are likely to be sitting there for some time. If you are fortunate to have lots of space on your airfield, park at 90 degrees to the glider's heading facing towards any winch launching but well away from it so that you can see what is happening with both with the glider about to be towed and also with the winch launching.

Now is the time for pre-takeoff checks. Normally turn the transponder on to A7000 with altitude encoding (mode C) on. This offers TCAS equipped aircraft extra protection from crashing into you! Efforts are being made to get a tugging transponder code, similar to our parachute drop pilot colleagues – watch this space. Always maintain about a 15-metre clearance radius from people, gliders and vehicles when taxying and don't taxy over your tow-rope, it can be picked up by the propeller.

18.1 **Before Launching**

Notice the call-sign of the glider you are about to tow – consider a radio check with that glider. Launch signalling is best done by the radio. Not all clubs will have the facility but it is strongly recommended that it is obtained, after all, hand held radios are relatively cheap nowadays. Hand signals from behind are difficult to see and it is unlikely that the tug pilot will be able to react quickly to a stop signal. Forward signallers are rarely put far enough forward and are usually in danger of being hit by a glider ground-looping on take-off.

Be very aware of:

- **Cables laid out on the field**
- **Cables still in the air**

Watch out for:

- **Winch launch tow hooks**
- **Low-experience glider pilots**
- **Short tow ropes**
- **Lightweight glider pilots that might cause a rearward centre of gravity**
- **Turbulence and windshear**
- **Cross or slight tail winds**

It is suggested that if you have three of these things against you consider not launching that glider!

Once the ground crew are clear, move into line and follow the take up slack signal by moving gently forward using minimum power and without brakes. If you are not happy that the takeoff run is clear, DO NOT LAUNCH. At the 'all out' and without delay, take two seconds to move the throttle to full power, as you reach full power it is vital to check full power is being obtained. This is the only opportunity to check full power and the tow should be rejected if the rpm or manifold pressure is not within the range indicated by the aircraft handling notes. The tone of the engine could give you prior warning that all is not well but not with variable speed propellers. Full throttle should leave your fingers hovering over or around the release handle! Meanwhile try to keep straight as the glider has less steering ability than the tug on the ground. Before you unstick, check the in the mirror that the glider's position is normal and its airbrakes are in. Once airborne, smoothly transition to the climb allowing the tug to accelerate.

Any pitch or speed changes should be very smooth and gradual and made by primary reference to the attitude. Remember that tugs have quicker manoeuvre rates than gliders. Consider your options if you are unfortunate enough to have an engine failure after take-off. The most important actions being:

- Lower the nose
- Release the glider without delay

18.2 Take-off performance

In order for a light aircraft to be certified, performance figures must be published. However, the combination of different tugs, gliders, weights and conditions makes formal tugging performance calculations almost impossible. Use copious amounts of common sense here! Ask yourself the following questions:

- Am I going to tow a single seater, two-seater?
- Is the tug being flown solo or dual
- Is it a heavy or light glider?
- Has the glider water ballast on board and how much? (you obviously can't tell this by just looking)
- Are there obstacles in my climb-out path?
- Is there a head-wind?
- What is the cross-wind component?
- Is it a high airfield above sea level?
- Is it a hot day? (Density Altitude)
- Is the towing direction uphill?
- Am I towing off hard surface or grass?
- Is the grass short or long?
- Is the grass dry or wet?
- Am I towing a vintage glider with a low aerotow speed?

There can be advantages to flying more than one person in the tug, mainly for training purposes, but the performance penalties of flying that extra person need to be carefully considered.

Before each takeoff consider a point on the run where you could reject the takeoff. If you are not airborne at this point or not going to adequately clear any obstacles, consider releasing the glider and stopping ahead, if there is enough room, bearing in mind the glider also has to stop behind you. If it is safer, consider releasing the glider and then getting airborne on your own.

Gliders that are notoriously heavy to aerotow could include for example the Nimbus 3 or 4 with full water, DG505 or Duo- Discus.

If it the grass is long and wet consider not taking off at all. See http://www.ais.org.uk/aes/pubs/aip/pdf/aic/4P036.PDF for performance information without a glider on tow!

19 CLIMB

As stated, all tows should of course avoid any noise sensitive areas. In addition the route should be planned to fly under areas of lift whilst avoiding the smooth blue gaps, unless aerotow training is taking place, where the student might appreciate a smoother ride! Turns should be shallow but this should not prevent you circling in areas of lift with experienced glider pilots to improve tug climb rates. The first turn could be into wind to keep the glider within easy gliding range of the field at all times. Also when low, stay over areas where the tug could successfully land after an engine failure. If the tug is safe, the glider must be also. Avoid turning through or flying directly into the glare of the sun. During the climb try to vary the headings to reduce the risk of collision by showing yourself to other airspace users, helping to maintain a good lookout! Be aware that a club two-seater will usually be training, so remain close to the field and avoid excessive manoeuvring. For spinning exercises, the glider will need to be fairly close to the airfield. A cross-country pilot, in contrast, will want a fast direct tow to the nearest source of lift and is happy to be released much further from the field. Beware of not climbing into controlled airspace. Do not normally tow gliders to the downwind side of the site. Always bear in mind that the glider may release at any time and must still have had a beneficial launch. (A student will not be happy paying for a 2000ft launch from which he has to spend all the flight time flying directly back to the airfield.)

If the tug requires sustained forward stick pressure, the glider has probably gone to the low tow position. The glider will not be visible in the mirror, but the rate of climb and forward stick pressure prove that it has not released. Use normal towing speeds, and be aware that a slightly less nose-up attitude will be required. The glider should return to the normal tow before release, else it would not be obvious when it has released. If a glider does release in low tow, note the log and brief the glider pilot that this is not a good idea again and why. Normally the glider cannot get too low on tow, but if the tug's stick reaches the forward stop and the airspeed begins to decay, release the glider, but do not begin descent to quickly so as to avoid the glider below. Use of mixture control is not normally recommended above about 75% power. However, when doing a high tow it is normally acceptable to lean an engine even at full throttle just sufficiently to restore smooth running, this should not be necessary below about 4,000 ft agl. Be careful not to over-lean as this will cause overheating and reduce engine life. Because it is more stable, the low-tow position is sometimes best for cross-country retrieves. In warm weather and when towing slow gliders the tug engine can get too warm. If this occurs, speed up a few knots and if this fails to halt the temperature rise, wave-off the glider and land. Common reasons for an abnormally warm engine can include:

- **Oil:** Allow time for the oil to drain into the sump then check its contents and top-up if necessary. Engines run cooler with the correct amount of oil contrary to the popular myth of "cooler with less oil" but on no account overfill.

- **Oil Cooler:** Check it is not clogged with leaves, grass or insects and the cowling around it is in good order.

- **Engine Baffles:** Check for loose baffles and missing edging strips. Changed airflow patterns may alter the cooling effect.

- **Silencer Baffles**: Loose baffles will increase the back pressure which in turn causes overheating and a loss of power.

- **Carb Air Intake**: The air filter should be secure and not clogged. The hot air ducting and control should be secure and functioning correctly.

- **Oil Consumption:** An engine using excessive amounts of oil might have worn rings allowing hot gasses to blow by, these gasses will heat the oil in the engine core. Worn rings will also let oil into the combustion chamber, this is turned into carbon which in turn can cause pre-ignition and further overheating.

If in doubt, get engineering assistance.

20 GLIDER OUT OF POSITION

Glider pilots often practise 'boxing the slipstream'. As for the low-tow, continue to fly the tug's attitude using whatever control inputs are required. Heavy rudder inputs will be needed if the glider is out to one side, but caution should be exercised with large rudder inputs (See Emergency Procedures, section 40). Often this exercise leads to a bow in the rope and a sharp deceleration as it snatches tight. Do not initiate a turn, as often the glider pilot will rush this exercise causing a bow to form in the rope. This will then cause a snatch as it goes taut, but should not cause the tug a loss of control, just a little discomfort. Similarly, do not initiate a turn towards the glider if it is out to one side, as the resulting bow will snatch hard enough to break the rope. If the glider pilot does cause control problems, or demonstrates erratic flying that may put the tug at risk, wave it off and brief the pilot on the ground.

21 STRAIGHT AND LEVEL TOWING

This is often not taught or practised. If the combination is to fly straight and level, there is a danger of the glider catching up the tug. Airbrakes might be required to maintain slight tension on the rope.

22 RELEASE

Normally the glider pilot will release when he or she is ready - try to remain within gliding range of the airfield! The rocking of the tug's wings should normally be kept for signalling emergencies only and not used as "you have had your whack, it's time to release"! However, some competition launches brief to use this signal at top of launch. The tug pilot looks out to guarantee that it is clear ahead and immediately below, then checks the mirror to see that the glider has really gone and confirm the direction of release and ensure adequate separation. Some tugs have rear view mirrors with a narrow arc of view, making it difficult to see the released glider as they turn away. Tugs can be fitted with a wide angle mirror which might help in seeing the departing glider. These types of mirrors also help the tug pilot to see an out of position glider. Fly the tug straight ahead for a few moments to ensure separation and as an aid to engine cooling. If the glider has made it difficult for you to tell it has gone brief the pilot or an instructor later. Manoeuvre during the descent, this will aid lookout and make you more conspicuous to other airspace users.

23 DESCENT

At top of climb the engine is extremely hot and precise engine handling is required to prevent shock cooling damage. The cylinder head and the valve seats cool at different rates, so too low a power setting for the descent will cool the cylinders whilst the valve seat remains hot and expanded, causing a stress crack in the cylinder head.

Take sufficient time to accelerate to the correct descent speed whilst retarding the throttle to maintain the climb rpm and paying particular attention to the red line. There should be no notable change in engine note at this stage. Once stabilised, trim and take a further 15 seconds to gently reduce to the descent rpm (2000RPM and 90 knots, maximum 110 knots recommended for many tugs), maintain the correct descent speed, not too fast into a busy gliding circuit. Continue to avoid noise-sensitive areas during the descent, and try to fly in the sink between thermals.

Turning will improve your rate of descent without cooling the engine too rapidly, make you more conspicuous to other flyers and enhance your lookout. The good lookout is imperative as the tug is now travelling much faster than most gliders near the circuit. Listen to the radio to form a mental picture of what is going on. Try to avoid the vicinity of the winch run, as it may not be obvious from the ground if you are clear of the launch path or not.

24 CIRCUIT, APPROACH AND LANDING

It is essential that tug aircraft do not descend onto the circuit pattern, which increases potential collision risks because you are descending into your blind-spot. You should plan the descent to join the circuit level at or maybe about 500ft agl, approximately midway downwind or on base-leg. Holding level will allow the aircraft to decelerate into the white arc without touching the throttle. Because of the higher rate of descent the circuit could be flown inside the standard glider circuit but please be careful not to cut-up or land directly in front of a glider. Consider joining on an extended downwind leg at circuit height and simply reducing speed as you go downwind, this gives you less to think about than descending in the circuit and thereby stabilises the circuit and approach. Remember, in air law, power gives way to gliders. On a high-wing aircraft it might be best to be higher than the gliders and on a low-wing aircraft it could be better to be a little lower so as to aid look-out. Gliders or aircraft above the horizon normally show up better to the tug pilot, conversely, gliders or aircraft below the horizon might be less visible. These decisions could of course also be influenced by local considerations. There are many options open to the tug pilot, different weather conditions, each day, each approach and each airfield could evoke a different circuit pattern. Select flap as necessary and position for a steep approach reducing the throttle steadily to idle before touchdown. This is to ensure maximum clearance of the rope in the later stages of the approach and make provision for smooth engine handling in the transition from descent power to touchdown. Try to avoid S-turns or orbits on final approach as it is too easy to fail to see a glider final gliding or any other aircraft or motorglider.

Once stopped, consider which way to vacate the runway, bearing in mind that approaching aircraft may be expecting you to turn left. Try always to turn away from any winch run. Taxy back, and if the next glider pilot is not completely ready to launch, shut down. Plan where you park to minimise obstruction and ground running time repositioning the tug for the next launch.

25 LANDING IN A TAILWIND

Beware if you are landing a tail-dragger in a tailwind, even a slight tailwind. As you slow to a groundspeed of a few knots the rudder operation could reverse due to the relative airflow blowing over the rudder from behind.

26 GO-AROUNDS

These are potentially hazardous, due to the possibility of a winch launch in progress, or a glider on an abnormal approach. If the landing area is blocked, make an early decision, as some ropes are 200ft long and trail far below the tug. For most tugs the normal go-around technique would be appropriate. Apply full power simultaneously pitching up to the climb attitude and retract any drag flap. Consider dropping the rope if necessary and call going around on the radio so that others are in the information loop. Turn sufficiently to move away from the winch run without cutting across the circuit, and when sure the circuit is clear, rejoin for a landing.

27 TURNAROUND

There is no need to do a full engine run-up before each launch; you have proved the engine by just flying the aircraft! However, if there are any doubts about anything conduct full checks. It might be worth considering some simple concise checks in between towing to ensure important things like: you have enough fuel on board, the trimmer is set, the carb heat is too cold, the hatches are closed and the flaps are set. You are however encouraged to use your aircraft's pilots operating notes.

28 SHUTDOWN

Do not normally stop the engine while still moving - this appears very slick but is not very professional! When you have just landed idle the engine for approximately one minute at 1000 RPM or so to allow engine temperatures to stabilise.

Switch ALL non-essential electrics OFF, including Fuel Pump and Radio.

Normally shut down the engine by closing the throttle and then pulling the Mixture control to idle cut-off (ICO). In emergency – if for example there is a risk of collision - turn engine off using the mags as this will stop the engine quickly. Consider a live mag check at low engine RPM before shutdown. After the engine stops, switch Magnetos OFF, remove key and set the master switch to OFF. Periodically consider turning off the engine by selecting the fuel off. You might be surprised how long an engine will run in this condition! Please don't forget to turn the fuel back on! Most clubs leave the main fuel selector on as a conscious risk assessment – this reduces the chances of somebody taking off with the fuel off!

29 FUEL AND OIL

No tug (or any other aircraft for that matter) should fly with the low fuel light illuminated or below the minimum stated fuel level. Generally counting one gallon per 1000ft of tow height errs on the safe side, but all tugs are different! Annotate the 'in-tug' log sheet when refuelling, and always check the oil level before returning to the field. Most "average" tugs achieve about 30,000 ft of towing from full tanks (not normally in one go!). Keep a record of refuelling and fuel used, to monitor performance and enhance safety. Try to anticipate tow demand, and refuel when demand is slack; similarly, try to ready the tug with full fuel before peak demand occurs, i.e. before it gets soarable or before launching the grid on a busy day. Tugs should be refuelled at the end of each day as a full fuel tank is less volatile than a part-empty one, unless a request has been made by the tug master for engineering purposes. Observe any fuel temperature limitations such as 20°C Fuel Temp for Mogas. On a hot day an aircraft left in the sun can easily achieve fuel temperatures far in excess of this and can exacerbate the problem of vapour locks in the fuel

system even when using Avgas etc. Remember refuelling safety precautions such as having an appropriate fire extinguisher available, earthing and bonding to prevent sparks, fuel water sediment checks and filtering of any fuel from jerry-cans. Aircraft brakes are normally left off on level ground during refuelling so that the aircraft can be quickly pushed away in the event of a fire.

Light aircraft fuel quantity gauges can be unreliable, if the gauge indicates you have used less fuel than expected, check the contents physically, the chances are you have used the same amount but the gauge is reading erroneously.

Oil should be kept in a remote fuel store – ensure that the correct oil is being used, it is normally different oil in a new engine, before topping up the engine level (the oil type and grade should be identified adjacent to the filler point) – try not to overfill!

30 CLEANING

Tugs should always be washed after flying to remove mud and dirt, and importantly, to remove corrosive exhaust emissions. Don't spray cold water directly on to a hot engine; this can cause damage due to shock cooling. After removal of large quantities of mud, consider re-lubricating the hinges, normally a light, low freezing point oil is used such as Aeroshell 3 (WD-40 and similar products or engine oil are not normally suitable unless specifically specified by the aircraft manufacturer). Windscreens must be kept clean throughout the day, using a clean cloth and water, or non-silicon based spray polish and a soft cloth. Harsh tissues scratch Perspex so avoid their use.

31 HANGARING

Generally the tugs are the last aircraft to go in the hanger and are located in the front. They are normally the most expensive thing in the hangar and can be pulled out first in the event of fire. Ensure that the parking brakes are left off to aid extraction! At this point it is worth checking that the aircraft master and magnetos switches are both set to off. Consider leaving fuel on as stated earlier, risk analysis indicates there is potential for a pilot to attempt to get airborne if the fuel is constantly turned off outweighing the advantages of having the selector off while in the hangar. At any rate ensure that there is a general philosophy that every tug pilot is aware of. Avoid pushing or pulling any aircraft by its propeller – there are normally alternate, safer places to push and pull your machine! Remember, a propeller can turn and fire – just one turn at any time, this will really ruin your day! A live mag is not uncommon and can cause this to happen, so can a hot bit of carbon in the pot. The answer is simple really – ALWAYS TREAT A PROPELLER AS LIVE.

32 GLIDER BADGE AND RECORD FLIGHTS

FAI rules for all badge and record claims allow a maximum start of 1000m without incurring a penalty. If the pilot is starting off tow, it is important to arrange the flight so that the release is with the maximum possible energy, in the correct sector for the start, and running on the first track. Ask for the first turn-point, and aim to be approaching 3000ft on the reciprocal track from the airfield. Turn to run in on track towards the airfield, and on reaching 3200ft accelerate to maintain level flight. The glider will release just before reaching the overhead. Be sure to log the exact position as well as time of release. Your signature will be required on the claim form after a successful claim.

Even if the glider releases from a more normal tow before a claim, the tug pilot is still required to certify the exact time and position of release on the paperwork, so be sure to record it.

Silver distance attempts may require a similar tow but to a lower altitude. The 1% rule states that the angle between release height and landing point must be less than 1 in 100; i.e. if a pilot flies exactly 50km and lands at the same altitude as the departure airfield the tow must be no higher than 1640' (500m).

33 SLOW AND FAST GLIDERS

Tugs may, of course, launch wooden gliders, but certain vintage gliders have very slow max aerotow speeds. The minimum towing speed for tugs is often around 55 knots, and should not be any lower as the engine will overheat and control difficulties will be encountered if the engine fails. Use half flap for the tow, but remember to retract it after release before accelerating, otherwise you could over speed the flaps. Monitor the CHT carefully, and weave frequently as the high nose attitude will obscure your view. High-performance aerobatic gliders or heavy gliders often require towing at a higher than normal speed – check with the glider pilot.

34 TOWING WITH WINCH ROPE RETRIEVE SYSTEMS

The advantages of fitting a winch rope retrieve system include:

- Reduced opportunity for snagging the rope on landing
- Reduced opportunity for snagging the rope while taxying
- Being able to land nearer the launch point thereby reducing costs such as fuel and servicing

The disadvantages include:

- The costs of fitting the winch retrieve system
- The costs of servicing it
- The extra weight to the tug
- The rope tends to be a bit shorter and a bit narrower than normal so it fits around the winch drum

If you decide to fit a winch rope retrieve system there are a few points to note:

- Extra tug pilot training will be required to ensure safe and efficient use of it
- During "take-up-slack" the winch normally pays out the rope, the rope can be marked to indicate when it is fully deployed
- Don't descend too fast as the rope drag can stop the winch from operating
- At around 160 ft, the rope is generally shorter than the normal recommended length of around 180-200 ft
- An emergency guillotine is fitted at the tug end of the rope
- The weak link is fitted at the glider end of the rope as normal
- Wire lock the regular rope release closed so that it cannot be used. The emergency handle in the cockpit of the tug can normally only guillotine the rope or release the standard rope – not both, so if the standard release mechanism is used the and the system configured for winch use the glider cannot be dumped by the tug pilot!
- An extra mirror is normally fitted so that the tug pilot can see when the rope is fully wound in, which should take about 25 seconds
- With rope fully extended, a "bobbin" should be fitted in the rope to take the weight of the glider on tow, the weight should not be taken by the winch

- Another “bobbin” should be fitted at the tug side of the weak link so the rope doesn’t wind its broken end around the winch in the event of the weak link breaking
- The retract rope switch in the cockpit should illuminate when the winch is in operation and extinguish when fully retracted
- A protection sheath is normally fitted to the area where the rope winds into the back of the tug to reduce the chances of the last part of the rope, weak link and bobbin assembly damaging the rudder

35 ROPE SYETEMS

35.1 General

Most clubs use an aerotow rope system which has become established over time and unless there has been very good reason “have always done it that way and it works”, and it is remarkable just how many variations on a theme there are around the country. Any aerotow rope system should always be tested against the requirement or “fit for purpose”, and getting a glider airborne is only part of the requirement. Safety considerations for the pilots, ground crew and spectators as well those relating to the security of the tug and glider, other aircraft, ground equipment and property etc must also be considered.

It is possible to buy a complete rope system off-the-shelf, but with no two airfields identical in all respects, the “one size fits all” approach may not satisfy local operating conditions. When considering safety critical equipment, purchase cost should never be the only factor and it is hoped that the points which follow will help clubs review aerotow rope arrangements, reinforcing or modifying the way things are done.

35.2 Factors which apply to all rope systems

Modern ropes have outstanding properties. Quality raw materials, careful manufacture and production control through “in house” testing laboratories guarantee that a rope will behave in a predictable, reliable way. Only use a manufacturer/supplier with high level of quality control. Such companies are willing to issue certificates of conformity underpinning their confidence in the quality of their rope.

There are two types of rope system. Those using heavier ropes approx. 10mm diameter, and those using lighter weight ropes approx. 6mm diameter. Both approaches have pros and cons, but the points which follow apply to whichever system is being used.

- It is useful to have an individual or small team whose job it is to oversee the ropes. An ability to carry out repairs etc is an added advantage for keeping the system operational and keeping down costs. A small stock of repaired ropes, spares parts and appropriate tools will ensure that there is minimal operational delay when the thermals are booming!

- An aerotow rope needs to be between 55m and 60m (180ft – 200ft). It should be fitted with the correct type of rings at both ends, compatible only with the glider or the tug tow releases. It makes life much simpler and safer if the entire fleet is set up to use the same rings and releases, if necessary colour coding the correct matches.

- It increases the lifetime of the rope and reduces fatigue if the “eyes” at the rope ends are formed by splicing onto a nylon thimble, itself attached to a stainless steel ring. The weak link shackles are then attached to the ring, not to the thimble or rope direct.

- Unless the rope is specifically chosen to be its own weak link because of its breaking load (e.g. some of the light weight ropes), then the system must be used with at least one weak link incorporated at the tug end. There is an argument for having weak links at both ends, chosen so that the glider end weak link would fail before that of the tug end. The maximum load allowed for a tug end weak link is specified in its operating manual or towing supplement (usually between 4000N to 6000N), and this then dictates the value for the glider end (usually between 4000N to 5000N).

- Weak links are safety critical, and should be carefully checked before, during and after flying. This must be easy to visually inspect. There are several weak link systems to choose from. The most common use “fuse” weak links held in a carrier for protection. The open type of carrier are probably best as these allow easy visual inspection. Less common is the type which uses shear wires held inside a “trombone” carrier. These are more difficult to check and there is a temptation to use the wrong wire. Wear can promote weak link premature failure. Short weak link strops (0.5m) made up from rope with the appropriate breaking strength are another possibility. These are easy to check visually, but wear and fatigue limit their lifetime.

- The rope needs to be reasonably resistant to abrasion. “Heat setting” with a smooth exterior helps and some ropes are treated with an anti-abrasion coating.

- Resistance to UV will help to prolong the life and strength of a rope. Most ropes are now treated for UV protection but, even so, ropes which are not being used are best stored away from direct sunlight e.g. in a “rope box”.

- The rope should have limited stretch and elasticity in order to avoid “surging” aerotows and catapulting of the rope if released under heavy loading e.g. weak link failure.

- Heavy polyester/polyamide ropes absorb and hold more water (and therefore mud!) than the polyolefin types. This can seriously increase the overall weight of a rope and adversely affect the degree of “float” behind the tug. This could be a factor in the choice of rope if the airfield has public footpaths and access, power lines, trees or other ground hazards on the approach.

- If the system is to be kept fully operational without delays, then splicing repairs must be easy to do. Ropes with a core as well as an outer sheath need specialist repair, whereas the common three strand hawser-laid construction and some of the braided ropes with no core are easily “eye” or “end-to-end” spliced with only a 10% reduction in strength.

- Modern synthetic ropes do not suffer if stored wet for a limited time. The type or rope construction dictates the method and direction of “coiling”, but a general method which applies to any rope is to wind it onto pegs on a baseboard in a figure of eight. This also ensures that the rope is in a relaxed, non kinked condition when it is unwound and provided a manageable method when checking the rope for cuts, kinks, fraying, abnormal wear etc at the beginning and end of each flying day.

- If operating from muddy or sandy airfields or gritty hard runways, the ropes should be periodically washed by soaking and then “dunking and shaking” in a bucket of water. Pressure washing simply drives any grit deeper into the rope leading to increased internal abrasion. The weak links should be washed as necessary to allow adequate inspection of “fuses”, nuts and bolts etc.

35.3 Factors which apply to heavyweight rope systems

Heavier ropes are those which have diameters of 8mm or 10mm. The most common construction used in gliding tow ropes is hawser-laid three strand, standard or prestreched polyester. They have a braking loads which range between 15000N and 28000N (1.5 Tonnes – 2.8 Tonnes). They must be used with weak link(s), as described above.

Advantages:

- Good resistance to wear on high abrasion runways.
- The perception of strength may offer psychological reassurance!
- Less likely to get picked up in any over-run such as when a belly hook is being used.
- During a tow the gentle bow in the rope due to its weight, coupled with inertia, does damp out oscillations.
- They can be purchased ready made “off-the-shelf”.

Disadvantages:

- The decreased ground clearance of trailing rope, even more so when wet, can present a serious safety hazard.
- Very heavy to use and handle when wet.
- High unit cost.
- Bulky to transport and store.

35.4 Factors which apply to lightweight ropes

Lightweight ropes are those which have diameters of 5mm or 6mm. The most common construction for gliding tow ropes is three strand prestreched, heat set polyester. Polypropylene has also been used successfully. These ropes have a breaking load which puts them within the weak link values for tug and glider and thus can be used without any additional weak link systems. However this does depend upon careful choice of rope and supplier, such that the rope when new has a guaranteed breaking load of 5000N to 6000N. (The use of lightweight rope without the use of weak links is an approach being adopted nation-wide in New Zealand).

Some users prefer to switch the rope around so the same end is not always used on the tug. This has the advantage of distributing the wear evenly, but it also means that it becomes difficult to predict when a rope is most likely to fail. By using the same directional sense, fatigue and wear are most likely to develop at the glider end where they are most likely to be spotted and help avoid actual rope failures.

Advantages:

- Much reduced water absorption and retention.
- Increased “float” during approach and landing.
- Low stretch and good UV resistance
- Low bulk means easier ground handling, storing, transporting etc particularly in wet conditions.
- Lower unit costs
- Low tech solution for situations where a retract system would be desirable.

- The ground crew can quickly substitute a spare lightweight rope complete with rings for a problem rope, thus keeping the launch point running smoothly.

Disadvantages:

- The thinner rope may cause a psychological perception of weakness
- Lightweight ropes have an occasional tendency to "self-knot" either on release from tow or during the ground run just after landing. This is not a problem provided they are spotted when first formed and are then easy to undo. Unfortunately they can be missed, the knot is then towed on and the strength of the rope is reduced by about 50%.
- The rope is more likely to catapult forward on release under load such as a weak ink breaking. Self knotting and catapulting have been successfully addressed by using 5 or 6 short 30mm lengths of 32mm internal diameter, yellow plastic gas pipe threaded onto a short heavy rope strop (10mm dia 1.5m long). This is inserted between the main rope and the weak link (if used) at the glider end, providing extra drag. This also has the added advantage of increased visibility on the ground.
- The ropes are not suitable for high abrasion surfaces.
- Because of the need for careful inspection and repair these ropes are more maintenance intensive.

The BGA is currently (Spring 2006) reviewing the use of UHMPTE ("Plasma") rope in place of steel cable for winch launching. This rope is incredibly strong e.g. a 5mm, 12-strand braded rope requires a breaking load of at least 2.3 tonnes. It must be used with weak links, but it more than meets most of the other desirable criteria for an aerotow rope and one club is actively testing it.

Further details will be available in due course.

The values above are representative of typical rope. The actual breaking loads etc must be verified against actual product data.

36 DUAL TOWS

Dual tows are not normally recommended, as there is no clear advantage to doing them in a normal club towing environment. There could be some advantages in certain situations such as dual glider retrieves, but not out of a field unless it is an extremely long one! Some dual towing suggestions are reproduced here:

- Use two ropes, one long and one short. It is harder for the glider pilot on the shorter rope, but also consider that if the short rope glider comes off it is also challenging for the pilot on the longer rope to avoid the glider that has come off in front. Suggested rope lengths for dual tows are 100 feet and 220 feet joined by a shackle to a common 3 foot length with the weak link and rings at the tug end of course. The ropes are normally laid out at about 30 degrees.

- Have a clear all-out signal as it is not as obvious when the slack has been taken up when there are two ropes

- Consider the overall load – two single seat gliders or a much heavier combination?

- Are the gliders carrying water ballast and how much? (you obviously can't tell this by just looking)Are there obstacles in the climb-out path?

- Is there a head-wind?
- Is it a high airfield above sea level?
- Is it a hot day? (Density altitude)
- Is the towing direction uphill?
- Is the tow from hard surface or grass?
- Is the grass short or long?
- Is the grass dry or wet?
- What is the cross-wind component?

Good communications and a thorough briefing are essential. On the ground run each glider pilot should attempt to follow the tug's wingtip. Wing tip runners should hold the outboard wing tips and be prepared for a longer ground run. When airborne the front, short rope pilot slips gently into the normal tow position and the rear, long rope pilot slips into the low tow position. If the combination is to fly straight and level, there is a danger of one glider catching up the other, or the tug. Airbrakes might be required to maintain slight tension on the rope and this should be emphasised in the briefing. When it's time to release the front pilot does so first so the dangling rope does not tangle with the glider still on tow. When that glider is clear the second pilot on the longer rope climbs to the normal tow position and releases as normal.

37 FUELLING PROCEDURES

37.1 **Fuel Sampling**

Before the first refuel of the day, the following regulations should be followed. It will be worth doing this before flying starts if it looks to be a busy day, to save glider-waiting time when you go to refuel with a long queue.

It is a legal requirement to take a fuel sample from the bowser or fuel tank before delivery to the aircraft to check the absence of any water, sediment or cloudiness. These samples must be kept for a minimum of seven days, after which they may be returned to the tank to save wastage. Also the storage tank must be dipped and checked for water contamination. To this end, a fuel-testing log should be provided in the bowser. Daily samples should always be full of fuel for inspection by the authorities in case of an accident to any aircraft that has uplifted fuel from the club's pump.

37.2 **Daily Sampling Procedure**

Look at the fuel sample log sheet to determine which sample jar is the next in sequence. If uncontaminated, empty old sample back into aircraft tank if there is sufficient capacity, if not empty into main underground tank.

Fill sample jar. Record the sampling results on sheet and return jar to shelf.

37.3 **Weekly Sampling Procedure**

Frequency – once every week in winter, twice in summer months.

- Collect the bowser keys, the dipstick, the water testing paste, and some tissue.
- Open the bowser cover and tank lid (using a club key). Dip the fuel, noting the contents
- Smear a small amount of water detector paste on end of dipstick. Re-dip the tank. Paste will change colour if water contaminated. Wipe paste off dipstick.
- Close the bowser lid and cover; return dipstick, paste and keys.

PART 2
EMERGENCY PROCEDURES

38 ABORTING THE TOW ON THE GROUND

If there is a problem with the tug, the tug pilot should immediately release the rope. This has two functions: firstly it increases the separation between tug and glider and secondly and most importantly, once the glider pilot sees that they are “pushing the rope” they are likely to be fairly convinced that getting airborne is unlikely and they should now be prepared for the subsequent ground run and for avoiding the tug. The tug pilot should consider stopping ahead, but do so without heavy braking if possible and an attempt to steer gently to one side if safe to do so. At any point be very aware of the possibility of the glider rolling into the tug as tug brakes are usually much more effective than the glider’s. The danger point is while the tug is still firmly on the ground and the glider lifts into ground effect therefore losing the ability to stop quickly. If the glider pilot aborts the tow by releasing, if the launch is stopped from the ground or for any reason unknown, the tug pilot should seriously consider not getting airborne. This is because there could be a problem that the tug pilot is not aware of, for example (and it has happened) the tug’s wheel might have picked up a winch cable! The basic rule then could be: if it is safe to stop ahead – do so.

39 GLIDER AIRBRAKES OPEN

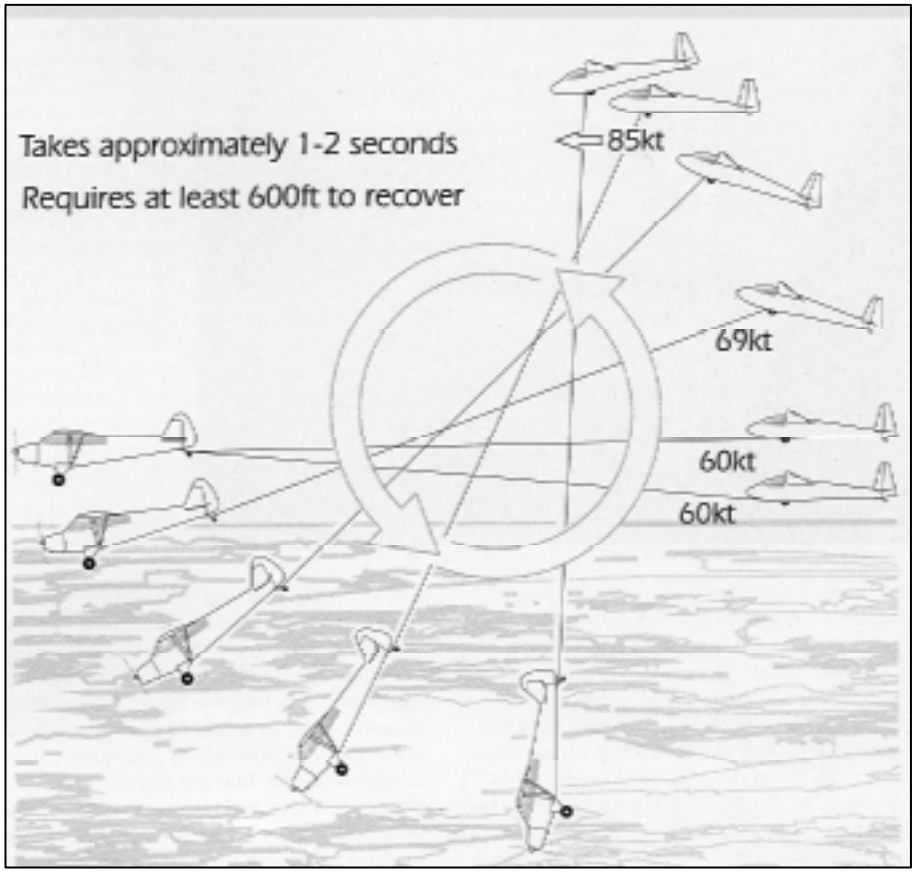
Glider airbrakes may open in turbulence, or because of the pilot’s failure to lock them properly. If the tug is climbing at a poor rate, first check the throttle is fully forward, carb heat is not on, both mags selected and the engine gauges are normal, then check the mirror. If the glider brakes are open, do not signal immediately unless absolutely necessary, try to get the glider to a safe height if possible, then signal. Remember, a dazed glider pilot is likely to just release at any sign of a problem. The signal for glider airbrakes open is to wiggle the rudder rapidly, try to make this an obvious signal to the glider pilot. It is the rudder waggle that is the signal to the glider pilot, not the yawing of the tug, which is to be avoided, especially at low speeds! If the signal is not well done, the glider pilot can mistake the roll resulting from the secondary effect of yaw for a wave off which could lead to an accident. Also consider using the radio to identify the problem, but only at a safe height, don’t let its use distract you from flying the aircraft. If the tug is maintaining height or even better, climbing, gently return towards the airfield and consider delaying the signal until within gliding range or over landable fields reachable even with full airbrake. Good tugs climb even with the glider brakes open, but if the tug is at risk, wave the glider off or release without delay.

40 GLIDER OUT OF POSITION

Glider pilots practising “boxing the slipstream” is a BGA exercise. Although uncomfortable to the tug pilot, this exercise should not cause control difficulties. If the glider gets way out of position near the ground and has the potential for handling difficulties, as always, consider releasing the glider and saving yourself (and the tug!). As a general rule, if you need full deflection of the elevator, it is time to let the glider push the tow-rope from his/her end – in other words, release the rope from the tug immediately!

41 TUG UPSETS

Tug upsets occur when the glider pilot gets too high and lifts the tug's tail uncontrollably. This tends not to happen from a pilot flying consistently high on tow, but rather from a pilot in difficulties a little low, perhaps in the slipstream, who suddenly 'winches' up behind the tug. This creates so much lift, and hence drag on the glider that the tug is not only tipped, but loses its forward momentum as well. From time to time over the years, tug upsets have occurred at low level from which the tug has been unable to recover, usually with fatal results. A glider pilot's aerotow training emphasises that correct position behind the tug is essential and that he must release if he is getting too high. However, tug pilots must be vigilant during the early stages of the launch for any tendency of the tug to be pitched nose down. At all times monitor the tug's attitude and if a significant backpressure is required to prevent any nose-down pitch – release immediately. Be aware that tug upsets can happen rapidly with little warning.



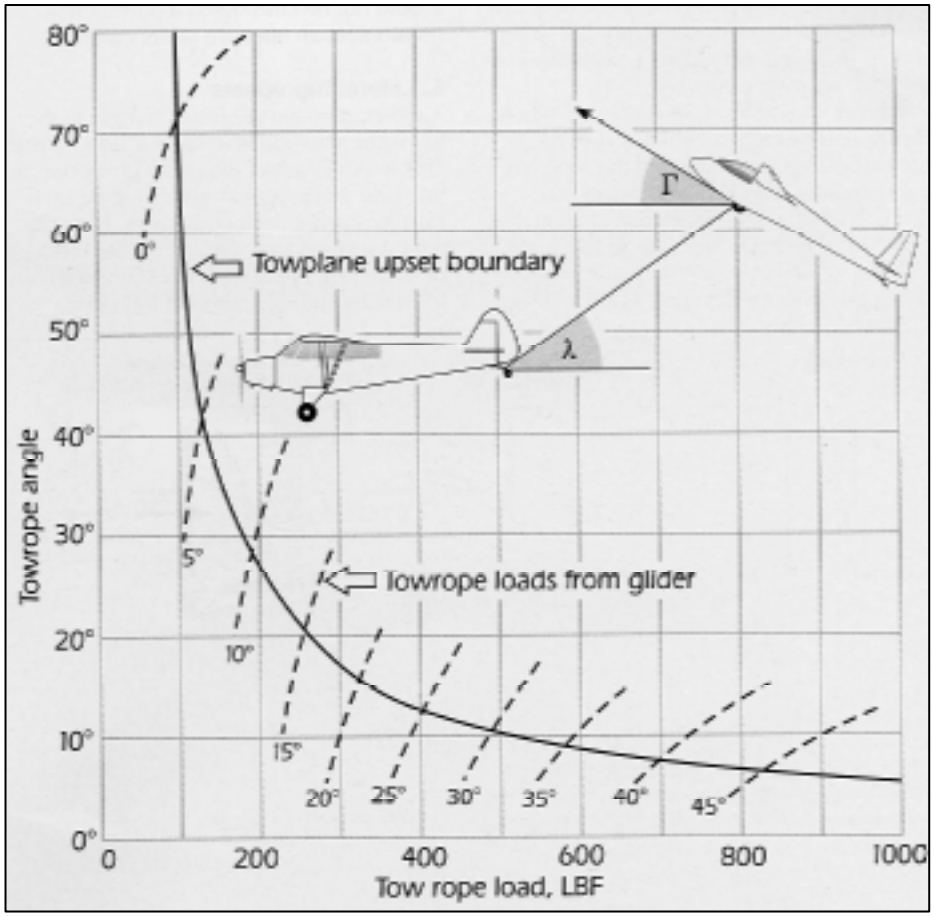
Typical sequence of glider 'winch launching' behind the tug.
Glider speeds are based on a constant tug speed of 60 kts.

There are a number of factors that increase the possibility of a tug upset:

- **A glider that is to be towed from a belly hook**
- **Gliders with high-set wings relative to the towing hook**
- **Gliders with a low wing loading, usually older or vintage types**
- **The presence of turbulent conditions, especially if associated with a strong wind gradient**
- **Glider pilots with low hours and/or aero-tow experience**
- **Lightweight pilots**
- **The use of short towropes will exacerbate the problem**

This list is not exhaustive.

A typical sequence is shown in the illustration on the previous page, with a simplified rope load/angle plot in the illustration below. In reality the situation is worse than shown because the glider zoom climbs behind the tug, its total energy increases (simultaneous increase in height and speed). This energy can only come from the momentum of the tug and therefore its speed will rapidly decay. This means that just when a high download is required to be generated by the tailplane/elevator to retain control and break the weak link on the rope, the capability to do so is vastly reduced by the decay in airspeed. This may result in the tailplane, and possibly the wing, stalling. Typically, 600 feet or more may be required to recover from an upset.



The solid line corresponds to the vertical component of the tow rope load which will upset the tug, and the dashed lines represent the loads applied by the glider calculated as if tow ropes were extremely long. For typical ropes, the loads are greater than shown – much greater for steep flight paths. The tug will therefore be upset at small rope angles by rather gentler manoeuvres than this diagram suggests. The rope weak links will protect the tug at the right side of the diagram ***while rope release is the only solution at the left side****.*

Also it is important to avoid a hasty transition from level acceleration to climb, as this will result in the glider becoming low relative to the tug. This can tempt the glider pilot to make a rapid recovery, with obvious potential for over correction.

Another cause of tug upsets occurs when glider pilots perform a climbing turn on release before confirming that the rope has gone. Arguably this is not so dangerous as it is normally performed much higher, but it could still give the tug pilot quite a fright. There are other destabilising influences for both tug and glider pilot, such as re-

trimming, flap and undercarriage retraction, instrument scan or canopy coming open. In a tug upset condition bear in mind that the rope release pressure can increase significantly. For the tug pilot, retracting flaps if necessary should be left to a safe height, normally at least 300 feet. Sometimes the upset can occur so rapidly that the tug pilot has no chance to react and release the glider. If any glider pilot gives cause for concern, do not hesitate to release the glider before he/she jeopardises the tug, being sure to advise the duty instructor that further training will be required. It is important that this retraining should not be considered a punishment (to promote an effective safety culture).

42 LATERAL TUG UPSETS

Another, dare we say lesser, danger to the tug is the situation leading to a lateral upset. This is as a result of the glider going out to one side and progressively diverging until the tug reaches its control limits. If the tug pilot continues to apply full rudder it is possible to stall the tug's fin. The sudden loss of directional control at this point is spectacular and very close to a flick manoeuvre. The violent yaw is caused by the rudder no longer opposing the rope tension, therefore allowing the glider to pull the tail round. As a result of the rate of yaw the secondary effect in roll is also very significant and can go beyond vertical. Although the wing may not always have stalled, the effect is similar to a flick roll. The need to release immediately is obvious as if the glider remains attached, the vertical upset scenario could develop. The lateral upset can be avoided by caution when applying large rudder deflections. If more than half rudder is insufficient to prevent further yaw then be very careful and allow the tug to yaw slightly. If there is a significant increase in rudder load or the glider continues to diverge then release. If the rope is released or the weak link breaks while full rudder is applied, the sudden yaw can also be alarming but not as violent as a fin stall. The difference in this case is that the tug will yaw towards the glider presenting a collision risk. The highest risk of a lateral upset is during the "glider cannot release" signal demonstration. As this involves a heavy two-seat glider going a long way out of position it should only be demonstrated only at a sufficient height. Once again, radio communications between the glider and tug combination might make the signal unnecessary.

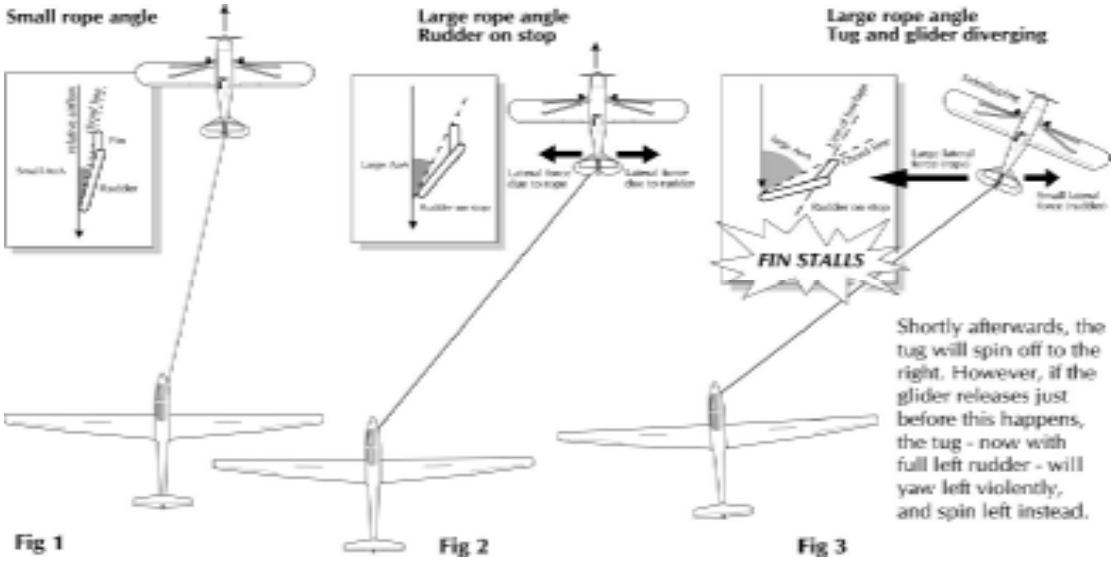


Fig 1 Fig 2 Fig 3

43 GLIDER UNABLE TO RELEASE

The glider pilot will fly out to the left (tug pilot's side of the aircraft) and rock the glider's wings. Take care not to confuse this with a wobbly student practising out-of-position exercises. Radio communication between the tug and glider may also confirm the problem. No immediate action is required. Firstly tow the glider back towards the airfield and to a suitable position for release. If the rope is taut, reduce power a little and check in the mirror that the glider is highish before releasing, so that the released rope remains clear of the glider. The glider pilot will probably fly back to the airfield with the rope hanging at an angle of about 45 degrees and land deep to avoid it snagging on anything. The glider pilot might consider releasing the rope in some circumstances, but consideration should be given to where the rope will drop.

44 BOTH TUG & GLIDER UNABLE TO RELEASE

In the extremely unlikely event of both the glider and the tug being unable to release, an on-tow landing will be necessary. Judicious use of the glider airbrakes will be necessary to ensure that the glider does not "overtake" the tug on the descent. The tug aircraft will normally carry out a slow descent and wide circuit with a long approach to a landing well into the field, the glider pilot maintaining an accurate position behind the tug and ensuring that sufficient airbrake and wheel brake is used to prevent "ramming" the tug from behind. The use of radio is once again recommended. The procedure is not normally practised in the UK. One club does have a go at it from time to time and their experience says get the glider airbrakes out, leave them out and don't play with them, and it then becomes quite easy.

45 SERIOUS TUG EMERGENCIES

In the event of a major problem, do not hesitate to release the glider as the time taken to give the wave off may compromise the tug's safety. Also remember that if you believe that the emergency could be mitigated by using an alternate procedure for whatever reason then, as always, use the options open to you.

46 TUG OVERHEATING

If the cylinder head temperature is approaching the red line, accelerate by a few knots. If this fails, wave the glider off in a safe position and land. Be sure to snag the tug and report the problem to an engineer.

47 TOTAL POWER LOSS

Release the glider immediately and fly the aircraft. Carry out a standard forced–landing procedure. Consider a restart if appropriate, put out a radio MAYDAY call and then run the type specific security drills, such as fuel, electrics off and harnesses secure, however and most important – fly the aircraft!

48 SERIOUS ENGINE VIBRATION

Rough running is often a symptom of carb icing; however carb hot air should not normally be selected with full power applied and is less likely at high power settings. Failing this, check the mixture, electric fuel pump on, magnetos both on, and try changing tanks. Shed propeller tips or spinner can also cause serious vibration. To prevent the engine shaking from its mountings, throttle back and consider shutting the

engine down, slow down to stop the propeller, which will reduce drag and carry out a forced landing (on the airfield, with a bit of luck).

49 ASI FAILURE

Check that the ASI is increasing during the ground roll and if there is a problem abort the tow before getting airborne if possible. If you do get airborne fly by attitude and keep climbing to at least a safe height. If you are very unhappy, wave the glider off near the airfield hopefully and conduct a normal approach and landing paying particular attention to power settings and attitude: power + attitude = performance.

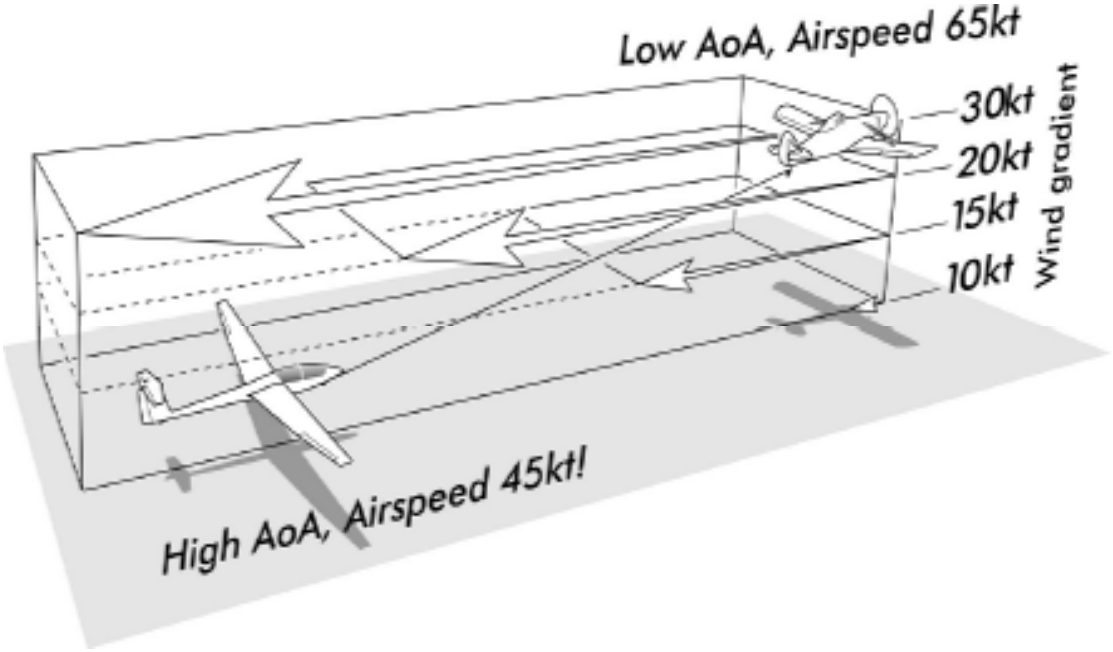
50 WEATHER DIFFICULTIES

50.1 **Strong winds**

Beware of turbulence and curl over from nearby trees or structures. Land as into wind as possible and using plenty of power on the approach. Do not hesitate to go around if badly rolled by gusts or if speed fluctuations are unacceptable. Once landed, avoid taxying or attempting to turn downwind, particularly in a Cub, Chipmunk or Pawnee. If necessary, shut down or get someone to hold the tail and wings as you taxy. If it is particularly windy, could there be mountain wave around? If you are scared put the toys away in the hangar for the day.

50.2 **Wind Gradient**

Exercise caution in the initial climb as a strong wind gradient increases the tug-upset risk. Check the position of the glider regularly to ensure you don't leave them behind in the ground effect. It is very easy in certain types of fairly high performance tugs to end up climbing through 100ft with say 75 knots indicated while the glider is at 50ft and at 55 knots and has insufficient energy to catch up, note the illustration below. It is vital to hold the attitude and not chase the ASI, accepting a higher than normal airspeed through the gradient until the glider is stable behind the tug. (Being towed too fast is not as bad as falling into the slipstream nearly stalled at 75ft with the tug climbing away from you.) Climbing into a wind gradient shortly after take-off creates an increase in airspeed and energy. Tug pilots should consider accepting a few knots of extra speed at this stage and avoid zooming up, which could leave the glider low and in less energy.



50.3 Poor Visibility or Low Cloud

If you are ever unhappy with the weather conditions, do not let a glider pilot pressure you into giving a launch. The average PPL holder will lose control in a matter of seconds once visual reference has been lost even with a full instrument flying panel. Tugs are not normally equipped for instrument flight. Remain clear of cloud, even if a lowering cloud base means a field landing is required. If caught by a local deterioration, for example, a large shower, consider holding off upwind until it has cleared. Alternatively consider landing at one of the neighbouring airfields. If landing in heavy rain, the windscreen could be obscured and visual clues can be diffracted, so consider looking out sideways to judge your height and land well into the airfield to avoid obstacles. On winter days turning into a low sun, visibility can be practically nil! Remember we still have to comply with the visual flight rules.

51 ACCIDENT AND INCIDENT REPORTING

The Civil Aviation Authority and the BGA operate something called the just or fair blame accident and incident reporting system. The Air Accident Investigation Board (AAIB) are not into blame, period, they are tasked with simply (or not!) finding out what happened. This means that these groups encourage feedback and are not in the business of punishing people unless the incident is clearly illegal or downright negligent. Please complete a CAA Mandatory Occurrence Report if you think others might benefit from your experience or observation. If you wish to protect your anonymity, consider submitting a Confidential Human factors Incident Report Procedure (CHIRP) report, which can be done online. Further information on accident and incident reporting and support for anything safety related is available from the BGA.

- BGA website - www.gliding.co.uk
- Chirp website www.chirp.co.uk
- AAIB website www.aaib.dft.gov.uk

52 SAFETY

Aerotowing does not need to be hazardous! Let us make it our aim to make it as safe as possible, but How? There is no magic answer. The solutions are numerous so let us examine some of them, starting with the technical bits:

- Ensure that your tug is kept up to a high standard of engineering and serviceability
- Ensure that you are licensed and up to date.
- Ensure that you are in current flying practice
- Obey CAA, BGA and club regulations and rules - they are for your safety

An out-of-date certificate of experience or a broken aeroplane is relatively easily identified and rectified, but now let us examine the more complex subject of human factors, which is important as it is present in about 75 per cent of accidents. Our problem here is that human factors are much harder to identify and rectify. There are numerous books on human factors in aviation, but the following points may be useful:

1. Be rigorous when operating aircraft. Lack of ”rigour” could consist of things like:

- **Complacency**: e.g. failing to follow a checklist
- **Distraction**: everyone is prone to this. What distracts you and why?
- **De-skilled**: i.e. being out of practice in certain flying related skills
- **Tiredness**: fatigue, heat exposure and dehydration

2. Reinforcing situational awareness.

   - **Now** – What is happening around you? (For example speed, height, position, configuration, FREDA checks)
   - **Next** – What is going to happen next and how am I going to cope with it? (For example, approaching controlled airspace – how am I going to avoid it?)
   - **Later** – What is going to happen later on? For example, at the end of this flight I am landing at an unknown airfield, have I considered all the options, what is their frequency and so on?

3. Error management. To err is human, we all make mistakes. Another Crew Resource Management (CRM) saying (slightly modified) is Remove, Avoid, Trap, Mitigate. If something is likely to catch someone out let us first try to *remove* that problem. If it is still there let us try to *avoid* it. If we fail to avoid it let's try to *trap* it before it does us real damage and after all that if it still gets us we try to *mitigate* the effects of resultant problem.

4. Decision making. This may not be very well taught in the aviation environment; perhaps it is because it is particularly difficult to teach! Maybe the topic can be divided into three areas:

   - **Rule based**, for example making a decision by following a checklist. An example could be, when driving your car and reach some traffic lights, we would revert to the *rule based* decision, a red light means stop.
   - **Analytical based**. In contrast, when the road ahead is blocked due to an accident we the *analytical based* technique, i.e. plan a re-route.
   - **Naturalistic decision making**. The argument runs that when we are confronted with difficult, time pressured problems or threats we will tend to take action on the basis of previously embedded patterns of behaviour. So a useful tool when things are going wrong and you are under pressure is another Crew Resource Management (CRM) phrase, DODAR which stands for **D**iagnose, **O**ptions, **D**ecide, **A**ct and **R**eview. A useful tool when things are going wrong and you are under pressure, but never forget the age old saying; *aviate, navigate, communicate – in that order!*

53 FIRE TRUCK

On an unlicensed airfield there is not normally a requirement to have any fire fighting and rescue equipment. However, it is strongly suggested that some sort of truck containing fire fighting equipment, rescue equipment and first aid kit is available. A list of actions in the event of an accident should also be kept in that vehicle. Immediate communications with the emergency services should always be available, so make sure the airfield mobile phone is charged and on the ground where it's needed. If your club has such a vehicle or facility, please ensure that it is actually available for immediate use. Murphy's Law says the truck is stuck in the back of the hangar just when it is needed!

Seek advice from the local Fire Prevention Officer regarding the fire fighting equipment to be carried on the fire truck..

It is probable that you will be recommended to have a modern type foam extinguisher such as AFFF (Aqueous Film Forming Foam). AFFF was developed specifically for fuel type fires and requires far less water to be carried than the old Protein (Bulls Blood!) foam.

CO_2 and Dry Powder will also be recommended. These should not be used in the vicinity of persons as they can cause medical problems.

Halon type extinguishers are not so common these days and have been banned by the EU in most cases, as they are ozone depleting.

PART 3
AEROTOW RETRIEVES

54 GENERAL

Normally, tug pilots in current navigational and radiotelephony practice and approved by the tug master should conduct retrieves from airfields or fields. Suitable proficiency and excellent handling and decision making skills are required before any pilot performs aerodrome or field retrieves. “Field” or non-airfield retrieves should only be undertaken with specific approval from the club tug master. Before embarking on a retrieve it is important that the following points are addressed:

- Permission must be obtained from the airfield operator or landowner.
- Tugs should normally be refuelled before departure, subject to performance requirements.
- The tug pilot must book out so people know where and when you are going
- A spare rope should be carried.
- A suitable map must be carried. (Air law)
- Consider which aircraft to use. A Pawnee is probably most suitable because of its take off and climb performance.
- If radio procedures are required, and most airfields do, then the Pilot must also hold an R/T rating.

On arrival overhead or in the circuit take some time to assess the landing area for approaches, size, surface - if you are not 100% sure then return to your home base.

If at an active airfield ask which run will be most suitable for departure, considering surface, length, wind, climb-out and other traffic requirements. Many airfields will not appreciate a glider blocking their main runway for long. It is unlikely that you will get the standard aerotow signals from ground helpers. Consider hooking on the glider yourself before starting engines, then the glider pilot closing the airbrakes when they are fully ready to launch. Obey any Air Traffic instructions.

Before take-off ensure that you do the following:

- Work out your contingency plan to cover actions in the event of an aborted take-off or in the event of rope break (release) soon after take-off. Brief the glider pilot accordingly.
- Decide on a tow speed to suit glider and pilot.
- Decide how the signalling is to be arranged and any other relevant details.
- Be sure you have checked performance to get airborne and clear obstacles. There is a very good CAA Aeronautical Information Circular (AIC) about performance factoring.

It is advantageous to have radio communication between tug and glider.

After take-off, do a normal climb out and then accelerate to your agreed tow speed. Once a safe height has been reached or a chosen altitude, reduce power to achieve a slight climb or level flight. If possible it is often preferable to reach the top of the climb just as the glider is achieving a glide back to base.

If it is necessary to descend on tow it might require the glider pilot to use his airbrakes to avoid catching-up the tug!

Consider briefing the glider pilot to adopt the low-tow position, as this is more stable. (It's like towing the glider up-hill).

Remember that until the glider releases, you are in charge of both aircraft and responsible for navigation and any RT calls.

55 PRE RETRIEVE PREPARATION

Once a field retrieve has been asked for it should normally be approved by the tug master and/or duty instructor. Having been authorised, do not be tempted to rush straight off to the field. As with all flights, thorough preparation is necessary before-hand.

We hope the glider pilot has made a successful field landing and in his opinion the field is suitable for an aerotow retrieve. However do not take this at face value. If at all possible talk to the glider pilot yourself about the field retrieve and be prepared to treat his comments with caution, especially if he has limited experience in field retrieves.

The most important points to establish at this stage are:

- The pilot's exact position – latitude and longitude if possible.
- That the pilot has permission from the owner of the field. Make sure it is the owner (a farm manager is acceptable) and not just someone who thinks he won't mind.
- Agree a frequency with the pilot to establish radio contact and an approximate ETA at the field. Make sure you allow time for flight planning, booking out, liaison with the office etc. Remember to book out or at least let somebody know where you are going and what frequency you will be operating on. Also give a good estimate of your ETA back at home base so that if something unfortunate happens to you people should be aware of when and where to start searching! Consider leaving your mobile phone number, but remember to turn your mobile phone off for flight.

56 LOCATING THE GLIDER

Once airborne (having carried out all the necessary planning) locating the glider should not be a problem if an accurate position has been given and plotted. Most pilots carry radio and contact should be made at least 10 nm before the estimated position. Often there can be more than one glider in a particular area or the glider may be obscured by trees, buildings etc so making contact with the glider pilot should help identify the field more quickly. By flying at around 2500 to 3000 feet you should have a good view of the ground whilst allowing the glider pilot to both see and hear the tug. If for some reason you have difficulty locating the glider remember to give due regard to airmanship considerations particularly fuel endurance, daylight and airspace. If after about 20 minutes or so you are unable to locate the glider and time allows climb as high as possible and try to establish radio contact with home base, it may be possible to relay if you are outside direct radio range. If this is unsuccessful, either land at the nearest suitable airfield and contact home base, or return to home base.

Once you have located the field you must start to evaluate whether the retrieve is possible. Inspect likely take off, climb out, circuit, approach and landing paths, also consider your options should you have an emergency. Be aware that conditions may have changed since the glider landed so make your own decision as to the best way to approach and land in the field. The factors described in the following sections must be given due consideration whilst airborne and must then be re-evaluated once on the ground.

57 AIRCRAFT PERFORMANCE

This will basically affect how much take off and landing run is required. In general, if the glider has made a successful landing and conditions have not changed significantly since it landed, the landing should not pose too much of a problem providing the correct technique is used. The soft field technique should be used for landing and the short field technique for take off. Obviously the field must have enough take off run available in the chosen take off direction to depart without the glider before a landing is attempted.

The factors which will influence take off and landing performance are described in the following sections.

58 AEROPLANE WEIGHT

Carefully consider weight - the addition of 150 lbs in the back seat may increase the take off run by 20% and the landing run by 10%.

A common error in the past has been when towing a two-seater out of a field. The glider is flown solo with two people in the tug; in general it is better to have two people in the glider because the glider becomes airborne at a slower speed than the tug. This then allows the tug to become airborne as soon after the glider as possible and therefore uses a shorter take off run.

59 GLIDER WEIGHT

Not only the weight but also the type of glider will affect take off performance. For instance some Open Class gliders may be quite heavy but will fly at a much slower speed than a Standard Class glider. Occasionally you may find some pilots will still have some water ballast left on board. In such cases, it should be dumped before departing. In general, as experienced tug pilots, you should be able to evaluate the different distances required by different glider types. There are however a number of exceptions: these are nearly all glass two-seaters which on occasions can require a very long run. Most notable is the Nimbus 3 or 4, DG505 or Duo- Discus. It is the tug pilot's responsibility to check that any water ballast carried is jettisoned before attempting to tow out of a field!

60 DENSITY ALTITUDE

Four things – altitude, pressure, temperature and humidity - determine density altitude. Two of these, altitude and pressure, are usually put together and are then termed pressure altitude. Performance calculations in the aircraft flight manual are calculated assuming the standard atmosphere for various heights. Unfortunately, life

is not that simple and any deviation from the standard atmosphere will affect performance. A decrease in pressure or an increase in temperature, altitude or humidity will decrease the performance of our aircraft and therefore increase the take off and landing run required. A reduction in performance of the engine and propeller in what is essentially thinner air cause this decrease in performance. Density altitude can best be thought of as the altitude the tug thinks it's at in relation to the standard atmosphere.

Whilst in this country we don't get really big deviations from the standard atmosphere, you may be surprised to know that in the summer with a temperature of 24°C, and a QNH of 1000 mmHg, the tug taking off from a UK airfield a couple of hundred feet above sea level will be at a density altitude of 2500 feet. To allow for this, the take off run should be increased by 10% for every 1000 feet increase in field elevation and 10% for every 10°C increase in ambient temperature. In the above case this will increase the take off run required by 25%.

61 SLOPE

If there is a significant slope to the field this will probably have the greatest bearing on take off and landing direction. Always land up the slope and take off down the slope, regardless of wind direction, when the slope is significant. Even a shallow slope will make a marked difference to the take off run. A 2% slope uphill (i.e. a 10 m rise on a take off run of 500 m) on take off will increase the take off distance by 10 %. Any slope greater than 2% should be considered as steep and the take off direction should be down hill unless there is a very strong wind.

62 LANDING

Landing on sloping ground requires care. The three-point attitude for touchdown is considerably steeper than in a landing on level ground and the round out must be prolonged by using power to bring the nose up to the required position to avoid a premature stall. With practice even very steep slopes can be landed on with ease. However, it is inadvisable to stop on a steep slope or allow the aircraft to run in any direction other than straight up or down and it will require a considerable amount of power to keep the aircraft moving. There must be a level piece of land after the landing run where the aircraft can be stopped. Turning must be done on the level or on only a shallow slope as should be the initial take off position at least for the glider.

If you decide to make a dummy approach or a go-around to a steep slope there is a point where this is not possible and should not be attempted. This point should be assessed before the approach is attempted and if necessary the approach should not go below the highest part of the field or obstacles in the go around path. Remember to allow for the extra ground speed and distance required if the approach is made down wind.

63 TAKE-OFF

Very good acceleration can be obtained when taking off down a slope and the take off run will be short. There are no special difficulties attached to this, provided the take off run is directly down the slope. Problems only arise with obstacles after take off or if the tow has to be abandoned. Before take off, check for obstacles below the

initial take off position and also rising ground in the climb out path. Remember if taking off down wind your ground speed will be quite high and can lead to flying too slowly once airborne. Look for any possible escape route if the tow has to be aborted; in general there isn't one so ensure you will not need it.

Do not accept a take off run with a dual slope or any run which gives a slope across the take off path of more than a few degrees; accidents have occurred due in part to this in the past. In this situation the glider becomes airborne first and because one wing is closer to the ground than the other the tendency is to try to level the wings to the ground. This results in the glider effectively sliding down the slope eventually pulling the tug's tail round and pointing the tug uphill; the eventual consequence is lots of paperwork!

64 SURFACE

This will probably have been established before departure to the field. However make your own assessment once you arrive at the field. Look for possible ruts, deep wheelings and any obvious changes in colour. Land along the wheelings where possible and avoid crossing obvious tracks and footpaths crossing the field. If the surface is damp this will increase the landing distance required by as much as 30% and if it's short wet grass this distance can be increased by as much as 60%.

A good procedure is to walk the take off run before departing, and on some occasions it may be necessary, if there is any doubt about the surface, to walk the taxy route after landing. Check for holes, ruts, sharp flints, rocks and soft patches, which should be noted and either moved or avoided during the take off. Expect the take off run to be increased by at least 30% when the surface is firm. If the field is soft this distance will increase further and may increase by as much as 100%.

65 WIND

Verify the wind direction and again remember it may have changed since the glider landed. Use the usual pointers such as smoke; cloud shadow, wind shadow on water, etc to confirm the wind direction. Also don't forget if you are working an air traffic unit they will be happy to give you a wind speed and direction for their airfield. Use as much into wind component as possible combined with the best landing/take off direction. Accepting a longer cross wind run may be a better option than a shorter into wind run.

66 FLAPS

Full flap should be used for landing to give the slowest touchdown speed. Soft field landing technique should always be used and the flaps should be raised as soon after touchdown as possible to put maximum weight on the wheels for braking and directional stability. For take off use take off flap in the Cub and 0 flap in the Pawnee to give best take off performance.

67 TAKE OFF RUN

Once the take off direction has been decided upon you should decide on a point where if you are not airborne you should abandon the tow. This point should allow the glider room to stop before the far hedge. This is particularly important when operating from soft fields. In some fields, for instance, where there is a steep down slope, once the take off has started you are committed. This must be included in your briefing to the glider pilot. Remember, the correct procedure for the tug pilot to abandon the tow is to first release the rope then on this occasion it is permissible and preferable, if room is available, to continue the take off. If you decide to stop, make sure you do not risk the glider running into the back of the tug.

Remember the old adage “there is nothing more useless than the takeoff run behind you”. So use the maximum takeoff run available in the chosen direction.

Ensure the takeoff run is in as straight a line as possible, and avoid any run which requires anything other than the slightest of curves. Also try to position the takeoff run well away from any obstacles bearing in mind any possible swing by the glider.

68 WIRES AND OBSTRUCTIONS

Establish where all wires, trees, masts and any other obstructions are before landing. Also note any obstructions in the field such as bales, water troughs etc. Do not descend below wire height until you are absolutely sure you have located all wires and obstructions. Do not forget to check the possible climb out and missed approach routes before making an approach. Obstructions on the approach will require the landing run to be increased by three times the height of the obstruction, and obstructions on the climb out will increase the take off run by five times the height of the obstruction. Try to avoid a take off path which will require a turn soon after take off to avoid an obstruction. If this is unavoidable ensure you include your intentions in your briefing to the glider pilot; if possible do not make the turn a down wind turn.

69 LIVESTOCK

Flying directly over animals during the take off, climb out, approach and landing must be avoided if at all possible. All livestock in the surrounding fields must be located whilst still airborne and allowed for when planning the field retrieve. If the approach takes you close to any livestock use a glide approach clearing the animals by as much height as possible. Horses are the greatest problem (and potentially very expensive) and should NEVER be over flown without permission from the owner. Any horse being ridden in the approach or take off path must be allowed to ride well clear. Sheep must be avoided during lambing. If, on arrival, you notice that you have no alternative but to take off over livestock then ask the owner if it would be possible to move the animals to the far end of the field or even another field if possible. Great care should be taken if operating from a field occupied by livestock, and in general should not be attempted unless the owner is with you in the field to help control the animals. Try to anticipate their likely reaction and leave yourself good options to avoid any problems.

70 THE PUBLIC AND THE LAW

Habitation, roads, railways, footpaths and any place where the public are likely to be has the potential of being one of the greatest hazards to face the field retrieve pilot. If you do not land i.e. either make a dummy approach, go-around or drop the rope, you are not exempt from the 500ft rule. It would appear that if any damage to persons or property occurs either directly or indirectly as a result of the retrieve, the pilot could be liable for prosecution.

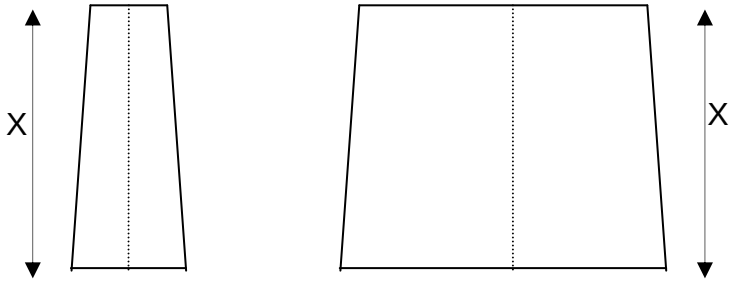
The only advice that we can give in these circumstances is do not over-fly large built up areas below 1000ft from any obstacle within 600 metres or at a height at which you could not glide clear in the event of an engine failure. Treat any public area e.g. car parks, footpaths, golf courses roads, railways etc, with extreme caution. If necessary adjust the landing/take off time so as to cause the minimum of surprise to the public.

Above all, use common sense. To operate the aircraft safely whilst causing the least amount of disturbance to people on the ground and stay within the law can be a difficult juggling act. If necessary warn those people adjacent to the field of the retrieve particularly the take off. Also be aware that what may be normal and safe practice to us may seem dangerous and reckless to the general public.

71 FIELD PERSPECTIVE

When judging the suitability of aerotowing out of a field the Tug Pilot must be aware of the subtle visual illusions that can result from the great variation in field size, shape and slope.

For those of us used to towing from runway based gliding sites, we will automatically feel more comfortable towing from ‘runway shaped fields’. Beware though, a narrow field or strip will give the perspective of being very long where in real terms it may be limiting. The opposite is of course as valid when towing out of ‘square’ type fields; when the available take off/landing run may look shorter than it really is.



Narrow field Wide field

The diagram above illustrates this perspective problem, both fields are the same length but when on the approach the narrow field would feel and appear to have a longer run available than the wide field.

Sloping fields can also lead to visual illusions. When approaching a field with a marked up slope the pilot may have the illusion that the strip is shorter than if it were level. The opposite is also true and whilst we would normally be landing up a slope, a down slope would appear longer than it really is. A dangerous situation could develop if attempting to land down hill and this would be compounded if the strip were narrow.

72 TOW ROPE

Do not arrive at the field with a towrope attached unless you are doing multiple retrieves. Unless the field is very large you will have to drop the rope before you land; pulling that unseen fence or power line out is guaranteed to raise the farmer's blood pressure! If possible brief the glider pilot to watch where the rope falls and make a careful note yourself where it drops using some feature in the field. This exercise should be carried out as unobtrusively as possible and is not, repeat NOT, an excuse for a beat up. An approach should be made in the expected direction of landing using the normal approach speed and flap setting. Level off at not less than 200ft above the highest obstruction and drop the rope well clear of any people, obstruction or gliders in the field - then carry out a normal go-around.

If the rope has to be shortened for take off because of a limited take off run then the retrieve should not be attempted. However as ropes appear to have grown in length over the years it is acceptable when operating from fields to use a slightly shorter rope. This helps the glider to take advantage of the prop wash from the tug when there is no one to hold the wing. Advice on ropes is also available in Laws and Rules for Glider Pilots.

73 TAXYING

This can often be the most heart stopping part of the field retrieve. Once you have landed in the field exercise extreme caution when taxying, particularly when turning. Cross wheelings and ruts at 45 degrees and if in any doubt shut down and walk the taxy route. If the Spring has been wet then the wheelings can be so deep that even a Pawnee at full power will not be able to pull itself out of them so be warned. If the field is suitable you can tow the glider to the take off position with the tug. However, be aware of the possibility of overheating on hot days; remember you will probably be facing down wind.

74 GROUND ORGANISATION AND BRIEFING THE GLIDER PILOT

Once in the field, decisions have to be made regarding the take off start point and direction, bearing in mind the previously mentioned factors. Be assertive and inspire confidence in the glider pilot and those people around the glider, make your briefings thorough, concise and to the point. Make your decision and above all act in a professional manner, do not be influenced by the glider pilot to use anything other than the best run available even if the glider has to be moved a great distance as a result of your decision.

Line the glider up with the tug parked at 45° to the take off run to allow a good view of both the approach and take off run, attach the rope to the glider and let the glider pilot get strapped in. Then brief the glider pilot of your intentions for the take off and climb out including the direction of any turns to be carried out. Agree a radio frequency to be used and signals for the launch, in general it is best to use the shutting of the canopy as the signal that the pilot is ready to launch. Inform the pilot that you will allow 30 seconds before starting the launch and remind the glider pilot that if he wishes to stop the launch just release the cable. Once the cable is released use the radio or open the airbrakes to indicate that he wishes to stop the launch. In general it is not a good idea to use an inexperienced person to signal for you, this can lead to confusion. Brief the glider pilot of your intentions if there is an emergency and in particular which fields are available for the glider to land in immediately after take off if

there is a rope break. If there is a wing person ensure they are briefed and in particular stress not to hold back on the wing. If there are any other people in the field ask them to stay behind the glider whilst the launch is taking place.

Once the briefing is complete and the glider pilot is ready get in the tug, start up and carry out the takeoff checks. Take one last look at the glider to see all is well and also check the approach and takeoff run to ensure it is safe to depart. Beware of the possibility of people entering the field once you have started the take off, so have a good look before you start to roll and once again try and anticipate any problems.

If there is no one to hold the wing take up slack and then hold the tug at full power on the brakes for about 30 sec to let the slipstream drift back towards the glider. If there is a crosswind, put the into wind wing down unless it is a glass glider with a tailskid. In this case the down wind wing may have to be down to counteract the weather cocking effect of the crosswind. In either case brief the pilot to pull off early rather than late if the glider starts to swing.

If the farmer/owner/manager is in the field make a point, even if you are pushed for time, of talking to and thanking him for his help; this is very important.

75 ABORTING A FIELD RETRIEVE

Remember: at the end of the day you are responsible for the tug during the landing and both the tug and glider during the take off. If you believe the field is not suitable then it's your decision not to land so go home. If you decide to land but not retrieve the glider do not be persuaded by the glider pilot. No matter who he is or what level of experience he has, ultimately you have the experience in field retrieves and as the tug pilot you will be responsible for the combination. If you are not happy, take off without the glider and go home, you won't be the first to do so.

76 EMERGENCIES

As with field landings in gliders, there is an increased risk when landing in unprepared fields. One of the aims of these notes is to try to reduce the risk.

It would be impossible to foresee every type of situation and emergency that could occur. However, what we must do is help you to cope should the unexpected happen. By far the best chance of dealing with an emergency situation is to have thought about it and already have a plan to deal with it. This takes imagination and a certain amount of fear and it is only by considering and practising the most common types of emergency that we are better prepared for the unknown.

PART 4
TECHNICAL AND MAINTENANCE

77 SECTION INTRODUCTION

The notes are intended as a general guide to glider tugging technical and maintenance aspects. Each club has its operating environment and problems and should adapt these suggestions to suit their own needs.

78 THE CAA, EASA AND BGA

The CAA has direct oversight of all UK aircraft operation acting as a Competent Authority of EASA (European Aviation Safety Agency). The BGA acts as an approved company in respect of technical and maintenance aspects. Tug maintenance may be conducted either within the BGA approved company or by any other suitably approved company outside the BGA, however the rules and requirements are essentially the same.

79 GETTING STARTED

Having decided what tug you want to operate and have found a gleaming example or one that requires some TLC and role modification to bring into service there are several points to be aware of.

80 BUYING YOUR TUG

It is strongly recommended that a full survey of the aircraft and records is carried out by someone who is familiar with the aircraft type. The cost of a survey will easily be outweighed by finding that serious work is required that you were unaware of. Ask yourself the question “Why is the tug being sold?” and find out the answer.

It is very important to establish that all the mandatory inspections and modifications have been accomplished and the records are complete.

If buying from outside the EU please ensure the aircraft type is EU approved.

81 NEW AIRCRAFT

If you are fortunate enough to be purchasing a new tug it is important that you get the correct documentation with it.

- **From within the EU**: an EASA form 52 - Statement of Conformity is required. You also need a Certificate of Non-registration, Equipment list, EASA Form One for various items of equipment, weight and balance schedule, and a Flight manual (in English).
- **From outside the EU:** a Certificate of Airworthiness for Export in lieu of the EASA form 52.

82 SECOND-HAND AIRCRAFT

Purchasing second hand aircraft is a bit like second hand cars! Be very careful you know what your are buying. Check the aircraft condition and the records very carefully. An aircraft without proper records and documentation will probably not get a C of A.

- **From within the EU**: You will need a domestic EU C of A or Export C of A issued or renewed within the pervious 60 days. You also need a Certificate of De-registration, weight and balance schedule, and a Flight manual (in English). All the previous aircraft records and log books. As a general caution, don't take anything on face value!

- **From outside the EU**: A Certificate of Airworthiness for Export, issued within the previous 60 days in lieu of the domestic EU C of A.

- If purchasing **from within the UK:** provided the aircraft has a current UK C of A, you only need to re-register the aircraft and collect all the documents from the seller.

83 IMPORTING

You may have customs duty and VAT to pay on your new aircraft. Talk to you local HM Customs and Revenue office. It may be worth applying for Customs End User relief.

84 REGISTRATION

You must register the aircraft before it can be issued with a C of A and fly. If from within the UK and on the British Register you are required by law to notify the CAA of the change of ownership. See the CAA web site for Registration details and how to apply.

Details are on the CAA web site - http://www.caa.co.uk/default.aspx?categoryid=56

85 C OF A

Your aircraft must under normal circumstances have a valid Certificate of Airworthiness to fly in UK airspace. All EASA types are issued with an EASA Standard C of A. There is no C of A differentiation for Private flying and Commercial Air Transport. The different classes are now determined by the operator and by the maintenance regime. By and large, all BGA Clubs operate tugs as private flying aircraft under a CAA exemption.

In some circumstances the CAA may issue a temporary Permit to Fly for positioning or test flying purposes. You cannot normally use these for towing operations unless specifically endorsed.

The initial C of A is issued by the CAA in conjunction with an M3 approved company. The CAA will normally survey the aircraft on completion of any maintenance that is due. Obviously a new aircraft will not need any maintenance but this may not be true for second hand aircraft. Expect at the very minimum to carry out a 50hour check. If the annual check is due, this will have to be completed.

In conjunction with your licensed engineer you should make the first contact through your local CAA regional office –

http://www.caa.co.uk/default.aspx?categoryid=288&pagetype=90&pageid=819

Some Tugs (Chipmunk/Supermunk) are Annex II aircraft and operate under the previous CAA airworthiness system and are issued with 3 year expiring C of A's, require flight testing and can be issued with Certificate of Fitness for flights under "A" conditions for positioning and flight testing.

86 OTHER DOCUMENTS

Depending aircraft type or on the equipment installed in the aircraft you may need some or all of the following;

- Certificate of Registration (all aircraft)
- Certificate of Radio Installation
- Aircraft Radio Station licence
- Noise certificate
- Certificate of insurance (all aircraft)
- Flight manual supplements for various items of equipment
- CAA flight manual supplements and change sheets for operation or equipment installed
- LAMS Maintenance schedule (all aircraft)
- Airframe and engine log books (all aircraft)
- Variable pitch log book
- Waivers against various Generic Requirements
- Time lifed task and component record (all aircraft)

87 NOISE ABATEMENT

In order to assist with noise abatement the BGA has pioneered various modifications and adaptations these include the fitment of 4 blade propellers and the installation of exhaust hush kits. The BGA hold various major modifications for these approved by the CAA and are available to BGA clubs free of charge.

88 USEFUL MODS

The BGA and some operators have modifications such as long life landing lamps, Pawnee strobe lights, mudguards, and additional maintenance access points. The BGA also has various tow bar mods for conversion to tug aircraft and can advise on tow cable retractor systems.

89 RUNNING YOUR TUG

Now you have your new tug up and running you must make preparation for the continued maintenance and day-to-day running.

90 RECORDING THE HOURS

In addition to recording flights for glider charging purposes, the flight times must also be recorded for aircraft records purposes.

With careful planning the same recording sheet can be used for both jobs so the pilot does not have any additional workload.

In the aircraft log book (Blue) DAILY flight totals and hours must be recorded and summed up at the end of each page.

The engine (Grey) (and VP propeller (Yellow)) times can, if wished, be lumped into weekly totals.

The flight times can be recorded in Hours and minutes or in Decimal Hours. If decimal hours are used a statement at the start should reflect this.

It is advisable to develop a robust system that will immediately identify if a sheet or block of hours is missing.

It is permissible to make a reasonable allowance in flight times for ground handling and taxy times. For normal club operation, up to a 5% deduction would be reasonable. For any more than this, a justification would be appropriate.

The log books record flight and operation times and these, in turn, are used for determining inspection and overhaul compliance.

91 TECHNICAL LOG

Aircraft used for private flying do not need to carry a Technical Log, however it is useful to record minor defects and fuel/oil uplifts as well as the DI (check A). A BGA Daily Inspection book will serve this purpose or, if desired, something else of your own design. It must not be called a Technical Log, as this will require CAA approval.

92 MAINTENANCE

The normal check sequence for LAMS aircraft is 50hr, 50hr, and 150hr checks repeating, with an annual inspection and, when the C of A is due, a Star Annual. Some aircraft require some maintenance action at 25 hour intervals (Rotax Falke running on Avgas) or after an initial period (25 hours after fitting a wooden prop). There are also other time lifed inspections to consider (magneto inspections, lift strut inspections, landing gear NDT) all dependant on aircraft type and mod status.

It is imperative that an accurate and up to date record is kept to monitor all the various time limits

Some maintenance checks can be extended in some circumstances. However, this is not a planning tool and should not be built into the flying programme. Reasons such as overrunning previous checks in the workshop, or illness are valid.

Some maintenance checks including C of A renewal can be anticipated without loss of time to maintain continuity. Details of extensions are in the LAMS schedule.

All maintenance check and time lifed items must be recorded in the appropriate log books. A record of checks is also maintained in the green pages and time lifed items in the pink pages as well as the time lifed task and component record. Maintenance items should be recorded in the log book within 7 days.

93 MAINTENANCE FILE

It is recommended that each aircraft has a maintenance file where the check record worksheets, defect sheets and other certification paperwork can be kept safely. The maintenance file would become part of the log book and aircraft records.

94 AIRWORTHINESS DIRECTIVES

Compliance with applicable Airworthiness Directives (AD) is a condition of the Certificate of Airworthiness (C of A). Non compliance could invalidate the C of A. AD's cannot be extended without permission from the CAA (unlikely!). Missing an AD may mean the aircraft is unsafe due to an unsafe condition not being identified.

95 ENGINE TBO

Engines used in the majority of tugs will have a recommended Time Before Overhaul (TBO). It is a condition of the LAMS maintenance schedule that these times are adhered to. However on the majority of engines used for "Private Flying" the TBO may be extended and run "On Condition". Generic Requirement 24 as published in CAA CAP 747 gives details.

It is worth mentioning that not all engines are included and there are certain maintenance inspections and qualifications. If the aircraft is to be used for Commercial Air transport the engine TBO has to be in compliance.

Engines do not last forever and typically a Lycoming 0-360 or 0-540 will be coming towards the end of its useful life at about 3,500 to 4,000 hours even with careful handling. After this the cost of overhaul starts to spiral as major components are beyond economical repair.

Engines are not run to the failure point.

During the lifetime of the engine it will also need Top Overhauls at approximately 1,000 to 1,500 hour intervals.

It is recommended that operators set aside funds to offset the overhaul or replacement costs as well as for unforeseen problems. The typical cost of a aircraft engine overhaul will most likely be in excess of £10,000 to £15,000.

96 PROPELLER TBO

If running a variable pitch propeller you should be aware that the TBO for these also has to be observed but, unlike the engine, there is no "On Condition" programme. If the manufacturer specifies a TBO, the operator must follow this or, if not specified, the inspections must be in accordance with CAA Generic Requirement 17.

Fixed pitch propellers do not normally have a TBO.

97 DOING IT YOURSELVES

To save money in Tug operation, many operators choose to do as much of the maintenance as possible themselves. There is a list of approved maintenance tasks that the owner/operators may certify themselves under the authority of the pilots licence. See CAA publication CAP 520 Light Aircraft Maintenance.

Anything outside the scope of “Pilot Maintenance” must be signed off, before flight, by an authorised person.

The authorised person will, in most cases, be a Type Rated Licensed Aircraft Engineer but in some cases a suitably authorised BGA Inspector.

Some clubs have gone the whole way and set up a maintenance facility able to carry out all the maintenance including C of A renewals. This is beyond the scope of these notes and interested clubs should contact the BGA Chief Technical Officer for details.

98 INSURANCE

In addition to the mandatory requirements for flight insurance, it is recommended that if you carry out maintenance of your tug you have adequate indemnity insurance. Consult with your insurance advisor.

99 C OF A RENEWAL

Periodically the tug will require a C of A renewal or revalidation. This can only be done at a suitably approved facility. The BGA runs a CAA approved scheme for this or you can employ the services of a commercial company.

A C of A that has expired for more than a year becomes a Subsequent Issue and will involve additional fees and CAA involvement.

C of A renewal flight testing is not required for EASA aircraft. (Annex II types still require testing)

100 MODIFICATIONS

You cannot modify your tug without approval. All modifications must be approved either by the manufacturer of the aircraft, EASA, or an organisation approved for the purpose by EASA. Unapproved modifications are not allowed.

It should be remembered that replacements are not modifications so changing a radio for instance, for another of the same type, would not be a modification. Changing it for another model or different type would, however, be classed as a modification.

It may be that you wish to modify an aircraft to use as a glider tug. Any major modification such as the installation of a towing system that is approved by the CAA will have an approval document called an Airworthiness Approval Note (AAN). Provided the mod is applicable and completed in accordance with the AAN no further approval will be required. You may need to acquire CAA supplements or change sheets for the flight manual.

Recently any modification approved within Europe such as FAA Supplemental Type Certificates (STC) can also be incorporated on UK aircraft without further approval. If the FAA STC has not been approved in Europe it will require approval before use.

It is worthy of note that when modifying an aircraft there are other complementary mods that need to be embodied, such as Cylinder Head Temperature Gauge (CHT) and recommended mods such as strobe lights.

101 FUEL AND OIL

Further to the advice in volume one:

- To operate your tug, you need to make prevision for replenishing the Fuel and Oil.
- Fuel installations are covered by very strict petroleum regulations and planning constraints. You should consult with your local Planning Officer and Petroleum Officer before making plans. The BGA development committee may be able to offer assistance in case of difficulty.
- Fuel uplifts must be recorded for taxation purposes and aviation fuel must not be used for road vehicles.

Oil should be kept in a secure store. The best and most economical way to buy is directly from the suppliers and in bulk, however this option is not always available and in those instances you may have to buy retail from your local supplier or airfield.

Always keep clean jugs and funnels exclusively for aircraft engine oil and record uplifts to monitor usage. Always use the approved grade of aviation engine oil for your engine as recommended by the manufacturer. Consider the option of modern multigrade oils, after the initial run in period where straight oil is normally used. Multigrade oil will improve cold starting and hot oil performance thus enhancing engine life. It is false economy to use inferior engine oils.

If draining oil, you must have suitable arrangements for disposal and adequate measures for dealing with fuel spills to satisfy the environmental obligations.

102 HUMAN FACTORS AND HEALTH AND SAFETY

Human frailties cannot be dismissed in tug operation. Operators must be aware of the “It will do” syndrome and “only one more flight to do” situation. This is when accidents and mistakes happen. The same is true with aircraft maintenance where it is often believed that, as it is not actually flying, the rules do not apply – wrong! Engineers are subject, by law, to the same fatigue, intoxication and medical requirements as pilots - only maximum duty cycles are not specified.

103 THE DUTY OF CARE OBLIGATIONS

Tug operations and maintenance is subject to COSHH and RIDDOR regulations and every effort must be made to reduce the risk of accidents and provide appropriate Personal Protective Equipment. See the HSE web site for more info - http://www.hse.gov.uk/index.htm

104 PUBLICATIONS

It is recommended that for tug operations you have access to the following publications:

Air Navigation Order - http://www.caa.co.uk/docs/33/CAP393.PDF
Light Aircraft Maintenance Schedule - http://www.caa.co.uk/docs/33/CAP411.PDF
Airworthiness Notices - http://www.caa.co.uk/docs/33/CAP455.PDF
CAP 520 Light Aircraft Maintenance - http://www.caa.co.uk/docs/33/CAP520.PDF
CAP 747 Mandatory Requirements for Aircraft - http://www.caa.co.uk/docs/33/CAP747.PDF

- CAA Tugging Exemption - http://www.caa.co.uk/docs/33/ORS4_584.pdf

105 WHAT THE FUTURE HOLDS

With the formation of the European Aviation Safety Agency (EASA) there are changes to the framework and procedures associated with aircraft operation and maintenance.

Part M (Maintenance) is due to be implemented during 2006 through 2008 with changes in the way C of A's are issued and renewed and the introduction of a non-expiring C of A with validation document. The function of the approved facilities will change and obligations on operators to maintain aircraft in a controlled environment.

At the time of publication these changes are not yet fully developed. Please monitor BGA and CAA web sites and publications and future revisions of this publication for the latest position.

APPENDIX 1 PILOT'S PRE FLIGHT CHECK LIST (CHECK A)

British Gliding Association

Pilot's Pre-Flight Check (Check A)

Pre-flight checks are to be carried out in accordance with the Aeroplane Flight Manual, Pilot's Operations Handbook, Pilot's Notes or Operations Manual. Some tasks may not be applicable dependant on type or equipment installed.

A1	General	Remove water, frost, snow or ice, if present. Check aircraft is clean. Check that the aircraft documents are available and in order. Ensure all loose equipment is correctly stowed and the aircraft is free of extraneous items. If the aeroplane has not been regularly used, ensure before resumption of flying that: a) either (i) the engine has been turned weekly or run fortnightly; or (ii) the manufacturer's recommendations have been complied with; b) **ENSURE MAGNETOS SWITCHED ARE OFF, THROTTLE CLOSED AND MIXTURE LEAN/CUT OFF** and check compression appears normal when the engine is turned by hand; c) Previously reported defects have been addressed.
A2	Powerplant /Engine	Check - oil level, security of filler cap and dipstick. Inspect - engine, as visible, for leaks, signs of overheating, and security of all items. (With engine extended or cowls open/removed) Inspect - air filter/intake for cleanliness. Check - security of cowlings, access doors and panels.
A3	Propeller	Inspect - blades and spinner for damage and security.
A4	Windscreen	Inspect - for damage and for cleanliness. Check towing mirror for alignment and cleanliness.
A5	Fuel System	Check visually that quantities are compatible with indicator readings. Drain fuel sample from each drain point into a transparent container and check for water, foreign matter and correct colour. Check sufficient fuel for intended operation.
A6	Wings	Check wing locking or rigging points for security and correct assembly. Inspect - skin/covering, bracing wires, struts and flying control surfaces for damage and security of all items. Check wings are clean. Inspect - pitot/static vents, fuel vents and drain holes for freedom from obstruction. Test operation of stall warning device.
A7	Landing Gear	Check - shock absorbers, struts, springs for leaks and that extension appears normal. Check - tyres for inflation, damage and creep, skid condition. Check for grass or other debris in wheel box. Inspect - brake installation for external evidence of leaks, and for damage and security.
A8	Fuselage and Empennage	Inspect - skin/covering, bracing wires, struts, and flying control surfaces for damage and security of all items. Inspect - drain holes and vents for freedom from obstruction. Inspect - radio aerials for damage and security.
A9	Cabin Area	Check - flying and engine controls, including trimmers and flaps, for full and free movement in the correct sense. (Positive control check if aircraft de-rigable) Check - brake operation is normal. Check removable batteries are fitted and secure. Check - instrument readings are consistent with ambient conditions. Perform manual override and disengagement check on auto-pilot. Check - avionic equipment operation, using self-test facilities where provided. Inspect - seats, belts and harnesses for satisfactory condition, locking and release. Check - emergency equipment properly stowed and inspection dates valid. Test operation of electrical circuits, navigation and landing lamps. Inspect - cabin and baggage doors for damage, security and for correct operation and locking. Check that markings and placards are legible.
A10	Miscellaneous	Check tow release for satisfactory condition and operation. Check towing placards legible. Check operation of retractor winch. **DO NOT TEST GUILLOTINE** Check hopper lid and redundant agricultural installations secure. Check towrope and weak links. Ensure headsets or ear defenders present and clean.

CAA/LANS/A/1999 Issue 2. Check A with BGA additions. Suitable for tug aircraft and self launching motor gliders.

BGA 07/05

APPENDIX 2 – SUGGESTED POSTERS

The following pages contain two draft posters that you can print out and display on your club notice board, at your launch point, on your fire truck, etc.

SAFETY NOTICE

Deaths have occurred due to powered aircraft picking up winch cables

Always remember:

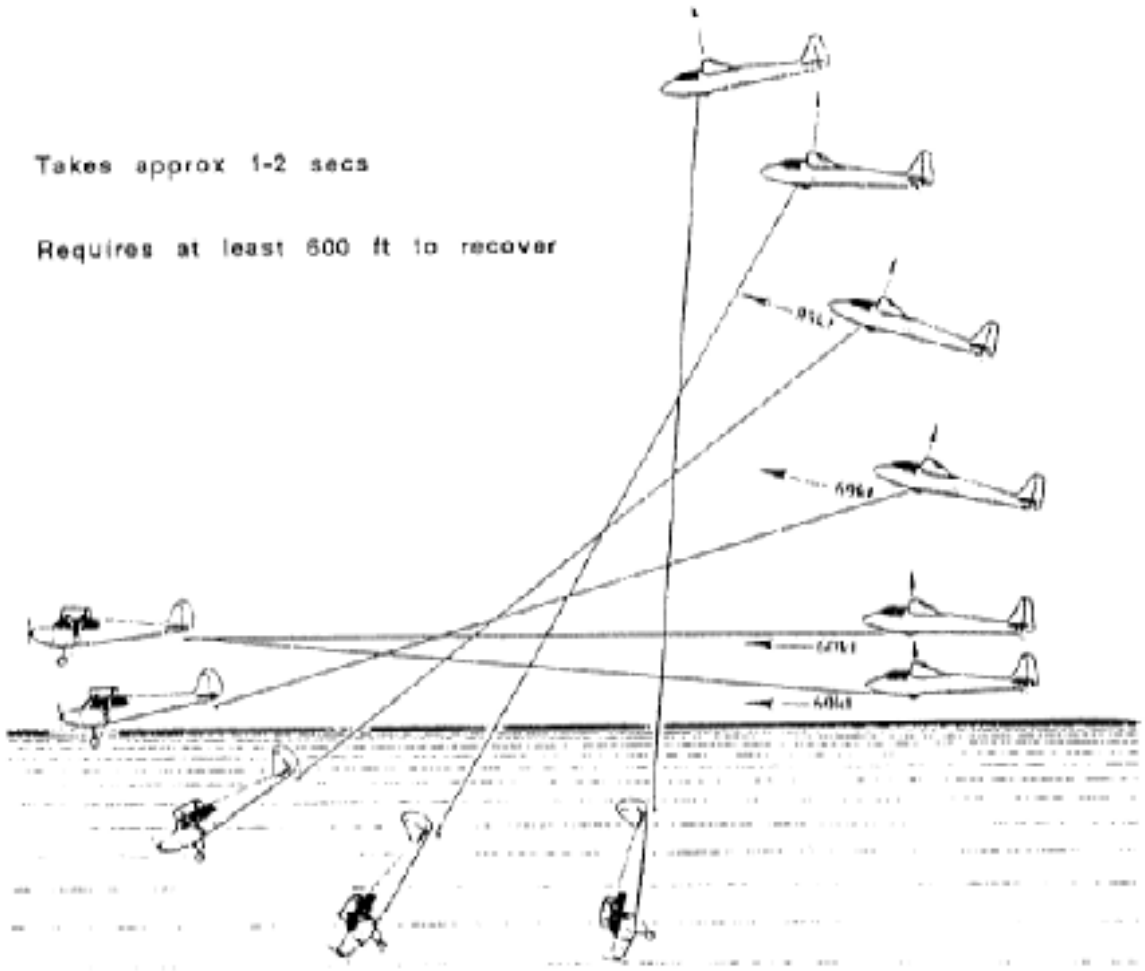
1. **Glider launch cables can be lying between the launch point and the winch. They are almost impossible to see from the ground or the air.**

2. **Avoid crossing cables on take-off and landing.**

3. **Check cable runs with the duty instructor on the club frequency.**

4. **Make your take-off or landing run well away from any cables.**

Understanding & Avoiding Tug-Upsets



Typical sequence of glider 'winch launching' behind the tug. Glider speeds are based upon a constant tug speed of 60 kts.

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