

GLIDER TOWING

The papers presented here have been brought together by Nick Bosdet, who has identified the need for information to enable would-be glider flyers to get started in contest flying. They have been culled from several sources and are by several authors, to whom we are most grateful.

Some of the older model flyers seem to be under the illusion that today's circle towing technique is much harder than flying a straight tow model and involves far more physical effort. In fact the opposite is true. Letting the glider circle on tow allows the flyer to rest; with a straight tow model you keep running all the time the model's on tow or else it falls off the towline.

These re-prints give you the information you need to enjoy today's competition free flight.

The first piece is by expatriate British flyer Jim Moseley, now living in Canada. It deals with towing a very simple beginner's glider, the Lulu, with a simple fixed towhook allowing straight towing only.

"LULU" - GLIDER LAUNCH

by Jim Moseley

First ensure that the glider, assembled, has all parts in line, with no warps (a little washout on each wingtip is fine) and check the auto-rudder release and dethermaliser systems for proper operation.

Wait for a day with just a light breeze and take a standard 50metre (164' towline) and a reliable 'helper' with you, plus some shims, modelling clay etc. You cannot tow a small glider on a dead calm day (and it's not too easy for larger ones either!)

Wedge the rudder in the straight-ahead position and make gentle hand launches into wind adjusting ballast, etc. until you have a very slightly stalling glide; if it shows an inclination to a slight natural turn then adopt that turn as your glide pattern even if requires a complete amendment of auto-rudder lines to suit (best done at home); otherwise adjust the rudder to indicate a gentle turn that just eliminates the slightly undulating flight you had previously.

Hook towline to model and link up the a/r and d/t lines. Your assistant faces squarely into the light breeze and holds up the model in one hand with the other lightly supporting a wing; you are now 50 metres away with a full line out – do not try to use short lines as models react faster on such – making sure that the model is directly downwind of you.

Look at the towline! If it bows to one side then you are slightly across wind, move until it droops slightly between you and your helper but with no side bias. You need reliable communication with your launcher, simple commands such as 'get ready' and 'go' for example; when you feel confident that you are directly into wind – that the wind is not too strong, and that the area ahead of you is free of obstacles, potholes, etc. - give a suitable 'launch/go' signal as you take up the slack in the line until taut and then run into wind briskly – not TOO fast -whilst looking over your shoulder at the model. This takes practice! Hold your winch in one hand with about 6/7 feet of slack between it and your towing hand.

To launch, your assistant holds the model into wind, nose up a little, and should allow you to almost pull the model from his/her hand whilst taking a step or two forward at the same time – the model should up rise from the hand. DO NOT THROW!

All being well the model is now in the air with nose up and starting to climb. You're still running but now you have to do two other things simultaneously – if the model is starting to pull hard, slow down ... ease the pressure on the wings; watch it carefully!

If it is starting to go up in a straight path, be grateful! If it swings violently to one side and starts to drop its nose STOP running, if necessary reverse and run towards the model and try to get it released from the line before it impacts; on the other hand if it 'weaves' from one side to the other – and back – just play it carefully on the line and release it as you think fit. To release, just stop running and let the model float off the line; if it's pulling fairly hard then simultaneously release the slack portion of line that you have been carrying with you. Do not try for full

line height at first, be content with achieving a safe release whilst learning the 'feel' of the model on the towline.

Once released, watch the glide closely. Stalling slightly in a very wide circle – increase turn a little; conversely too tight/steep a circle means less rudder and maybe a small reduction in ballast. Do only one thing at a time and observe the result.

So, the glide is safe ... now pay attention to the towline handling. The first thing mentioned previously – the side/downward swing is dangerous. The major reason is that the towhook is too close to the CG (it's unlikely as set up on the Lulu plan, but still possible), if you have any means of adjusting the towline ring further forward on the hook, do so and try a cautious launch once again – OBSERVE! Alternatively you can remove some nose ballast to move the CG a little to the rear, thus effectively placing the hook further ahead of it. Maybe do both... If the model still pulls a little to one side but without as much nose-down tendency as before you first check that you are still into wind (a crosswind will take the glider to one side in which case you run in opposite direction to the 'lean' to get directly back into wind and the model should then straighten up. It may also be necessary, now, to adjust the rudder slightly to compensate for any slight side swing on tow.

If the model weaves gently from side to side, the reverse applies – move back the hook position. Ultimately you are aiming for a model which kites to the top of the line in a safe and controllable fashion, quite rapidly immediately after release by your helper but adjust your own speed to suit that – and the attitude and 'pull' of the model. When you have it towing, releasing and gliding you can watch the glide more closely with the extra altitude and then fine-trim both glide and turn to give what you consider to be the best pattern for longest duration.

In 'neutral' air you will not get full line height. If you're running fast and the model is going nowhere but just following like a dog on a leash then either there's not enough breeze at all OR you're in a patch of 'sink' which you might run out of if your stamina is up to it. Mine isn't any more, but you're younger than me....

If it starts going up on the line, then accelerates whilst pulling like hell...STOP – it's a thermal! Run toward it if necessary, get the strain off the wings; it will end up right above you with the line bar-taut – to release pull the line down sharply to below waist level and release it – and the slack length – abruptly to flip the model off – it will

probably stall but then recover into its glide circle and now's the time you'll be glad you checked the d/t timer start system for suddenly it has become VERY important to you.

It may, similarly, accelerate to height whilst pulling hard ... but if the line then sags a little, rather than being taut, then you're merely feeling the effects of a strong gust – the same preventative methods, as in the preceding paragraph, still apply.

A well designed and trimmed glider – generally a little larger than a 'Lulu' – can be 'kited' close to the top of the line in a moderate breeze, with a little sag therein; however one has to constantly adjust line tension by increasing or slowing the towing speed to accommodate variations in wind strength – when a thermal is encountered then the airplane will strongly pull to full height, to be released . .but it takes experience and observation to be aware of the difference in 'feel' between a thermal and a gust.

I never said it was easy! Towing and flying a glider is an art which I cannot teach you – it comes only from experience. FEEL what the model is telling you through the line, whether it's pulling too hard and endangering the wing structure (and a gust can be very sudden – you have to be able to compensate almost instinctively), learn how to counteract a sudden swing due to wind shift, be cautious as you fly further in differing wind strengths – and ALWAYS use the d/t. Lulu's can thermal from very low altitudes – trust me, I know!

You'll probably fold the wings sometime anyway – it's part of the learning curve so do not be discouraged. You'd have done it sooner without the spruce spar you put into it. The smaller the model the harder it is to fly, oscillation and reaction rates are faster in comparison to larger airplanes; if you get to like what you're doing and want to go further I could point you toward my 'Night Owl' which was designed especially for this purposes, much like a 'Lulu' in many ways but a thick flat-bottomed 3-spar wing of 60" span, very strong, easy to handle and flies better than I expected it to when I drew it up!

Be patient, careful and precise and then practice with full line length and short d/t's, the more you fly it the more confident you'll get and the results will get better also.

Good luck!

This article by John Cooper appeared as two parts in Aeromodeller magazine in June and July 1979. Circle towhook design has advanced somewhat since then, but the basics are similar. For safety reasons it is no longer permitted to tow with a winch attached to the towline.

GLIDER TOWING

by John Cooper

Like most aspects of model flying, the art of persuading a glider to tow properly, whether straight or circle towing, is a matter of juggling all the forces acting on the model until they balance. Whilst it is easy to balance the forces well enough to achieve straight 'up and off' tows, it is far harder to trim the model to make it tow properly, either for long periods of time in windy conditions or for circle towing.

The following is intended to give advice on persuading your model to tow properly and is based on practical experience rather than theoretical reasons. Since I started glider flying in earnest about eight years ago I have built twelve straight tow and eight circle tow models so my observations are based on a fair assortment of models.

The preparatory stages of the trimming should be carried out long before you set off to the flying field and consist of ensuring that the model is set up correctly when assembled. All the wing and tail panels should be fairly flat although washout on the wingtip on the outer side of the glide circle is permissible. On no account should there be more than 1/32 inch wash-in on any panel. A common fault with two piece wings is that although the panels themselves are flat, the two halves are not aligned at the same incidence, either caused by badly installed wing joining tubes or by a distorted wing mount. If the wing has a multi-spar arrangement, the wing tubes must be installed a couple of inches apart to spread the towing loads between the spars and in this case, great care should be taken to ensure that the wing halves are constructed so as to join at exactly the same angle. If the wing has an I-beam spar arrangement, a better solution is to install both wing joiners close together and in this way the relative incidences of

the wing halves can be altered by suitable packing on the wing mount, see Figure 1.

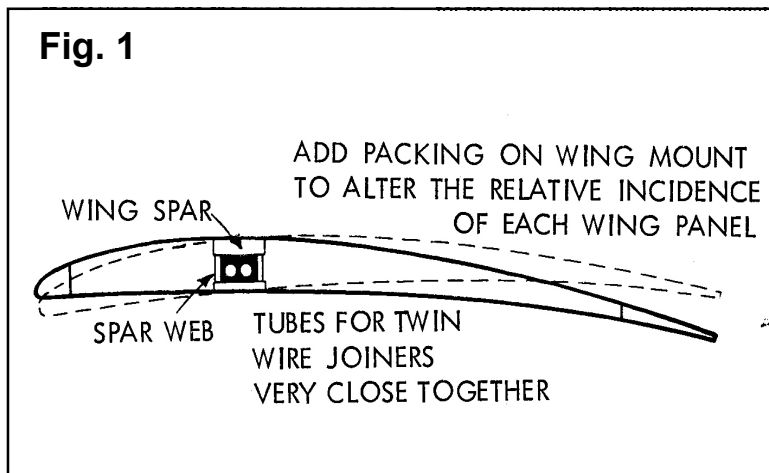
The tow hook should be set in approximately the correct position before test flying the model. This position is such that when the model is being towed near the top of the line, the towline, tow-hook and the CG are in a straight line. This hook position is about one inch in front of the CG on an average A2 glider. An easy way to set the tow hook position is to suspend the finished model from the tow hook and then move the hook position until the fuselage rear end is balancing roughly 20° below the horizontal, slightly less than 20° for straight tow and slightly more for circle tow is acceptable, see Figure 2.

The glide trim of the model must be approximately correct before trimming for the tow, since a badly under-elevated model will appear to diverge on tow and a badly over-elevated model will try to stall whilst on the tow line and will appear to be weaving, See Figures 3 and 4.

STRAIGHT TOW

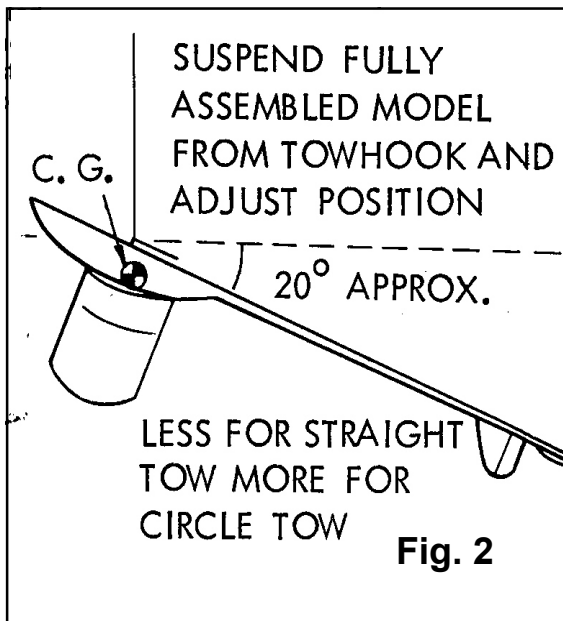
The ideal characteristic for a straight tow model is a very slight weave when flown in about a 15mph wind, whilst hanging off slightly to the side of the line that the model glides towards. When the model is speeded up rapidly whilst it is near the top of the line, it should start to gently bank into its glide turn before release from the towline.

Carry out the trimming when the wind is blowing at about 15mph. Trimming in calmer conditions does little good, since calm conditions don't really test the model's tow stability. Trimming in windier conditions causes confusion in trying to judge whether it is the model's trim that is at



fault, or if turbulence is upsetting the model (besides which you will wear yourself out continually retrieving the model!

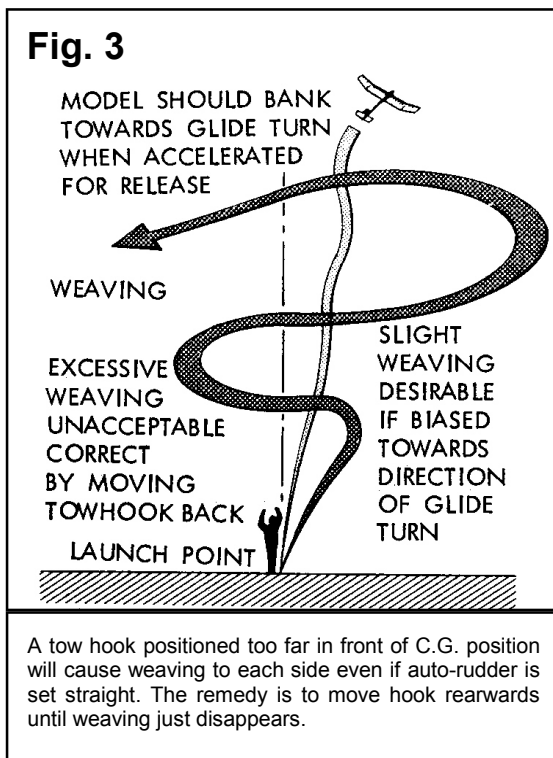
After setting the model up as described earlier, start your trimming by towing the model on a full length line with the rudder set straight. Over several flights adjust the rudder setting until the model tows as straight as possible. It will usually be found that the rudder has to be set up to 15° in the opposite direction to the glide setting, thus counteracting the effects of the washout on the outboard wing tip. If the model cannot be per-



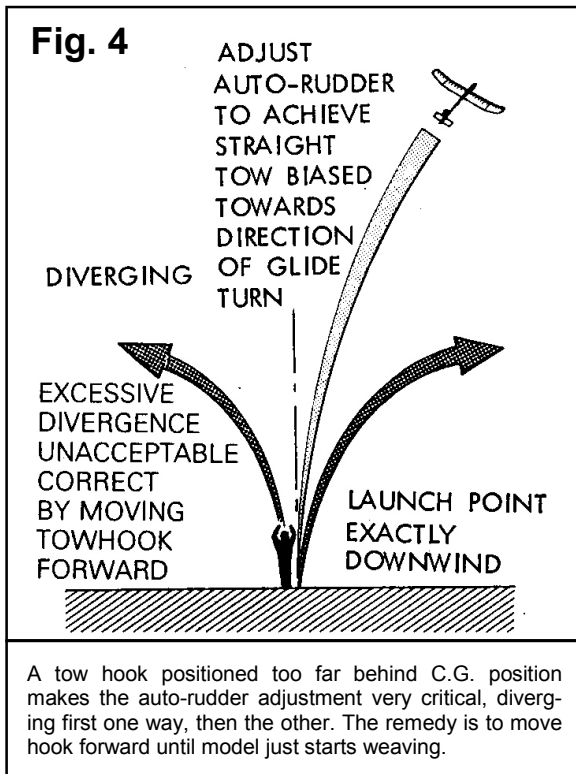
sueded to tow in a reasonably straight line by just using simple rudder adjustments or if it needs an excessive rudder offset to tow straight, then there is something wrong with the set-up of the model.

The most usual fault, and the easiest to correct, is an incorrect towhook position. If the model constantly pulls to one side on the initial stages of the tow (below 80ft altitude) and won't recover, try moving the hook forward 1/16in at a time. If the model weaves more than 15ft to each side of a straight line, move the hook backwards, again 1/16in at a time, until the weaving is only just noticeable. On no account should the hook be moved more than 1/4in from the position shown in Figure 2.

All the above adjustments are straightforward to carry out and should produce a straight tow with most models, particularly if they are to a well tried and tested design. If the model still cannot be made to tow properly then it is time to start altering its geometry.



Weaving is the easiest problem to cure and is caused by: too small a fin, too much side area in front of the CG or by too much dihedral. Experiment by altering these items, one at a time, until the weaving disappears. To alter the fin size try pinning extra pieces of wood in place until you see if this does the trick. Only glue in place



when and if you are satisfied with the result. Wing dihedral is best altered by bending the wing joiners and even if the dihedral looks low whilst the model is sitting on the ground. Remember that the joiners can bend when the model is towed fairly fast, thus increasing the effective dihedral. It is as well to remember that not all wire sold in model shops has the same tensile properties and it could be that your model has soft wire joiners and hence too much dihedral on tow. The remedy is obvious!

A model that constantly diverges to the same side on tow is not always so easy to cure. Constant divergence is sometimes caused by an oversize fin or too little dihedral; however these failings can usually be overcome by alterations to hook position or rudder setting, so if your model won't respond to these cures the divergence is almost certainly caused by unequal lift or drag on the two wing halves.

To find out whether it is lift or drag that is causing the problem try this simple test. Juggle your model on the towline until it is at about 50ft altitude and pointing squarely towards you, then run rapidly into wind so that the model accelerates sharply. If the model veers off to one side at a near constant angle, then the problem is caused by drag, whereas if the model progressively veers more and more it is caused by unbalanced lift.

Correcting for excess drag is the most straightforward to cure; firstly ensure that the two wing halves have a similar quality of surface finish and if this is so, simply cement a 2 inch length of 3/16 inch square balsa on the upper trailing edge surface, near the tip on the outside of the turn. Adjust the length of the wood until the model behaves in the desired manner. This set up looks very crude but works remarkably well.

If the divergence is caused by unbalanced lift, the cause is often a little amount of unintentional wash-in on the inboard wing panel. If alteration of the wing warps doesn't cure the model then try packing up the two wing halves to different incidences; this is where the twin-wire wing joining method mentioned earlier comes in handy. Usually very small angular changes in the relative wing incidences will give the desired result, although I do have one A/2 with a perfectly true wing that has the right wing at 2° more incidence than the left. The model seems quite happy to fly like this although it looks rather odd.

To finally test the model's towing stability put the model into a variety of odd situations i.e. by tow-

ing over-fast, towing crosswind and by having the model launched crosswind etc. It should by now recover to the straight and narrow fairly rapidly.

By following the above you should be able to get a model that tows steadily and indefinitely if needed. Final fine adjustment of the rudder setting should provide you with a model that peels smoothly off the top of the line into its glide turn (and away for a max !)

CIRCLE TOWING

The first essential before trying circle towing is to have a model that is trimmed for straight tow and glide. I therefore find that the easiest way to trim the model is to fit a straight tow hook to the model, trim it out for both straight tow and glide and then fit the circle towhook. This is far easier than starting off with a circle towhook, since movement of the hook position (to give a good straight tow as described last month) usually alters all the rudder settings on a circle tow model, requiring alterations to the rudder line length, all of which is rather difficult to achieve successfully on the usual cold, wet and windy flying field.

There are two basic forms of circle towing, the Russian spring loaded pivoted hook and the French offset hook with impulse release, plus a combined system, the Elton Drew Maxaid hook. All three systems have been described thoroughly in past Aeromodeller articles and further detailed description of each system would appear unnecessary. Having tried all three systems in the past I personally prefer the Russian style hook. The following therefore applies particularly to this style of hook but the comments will still generally be relevant to all types of circle towhook.

Before describing how to trim the model, a few comments on my hook system would appear to be appropriate. As previously mentioned the hook is basically similar to the Russian system but has one fundamental difference in that all the rudder adjustments, except the catapult launch setting, are made at the rudder end of the model rather than at the hook end. I feel that this gives far more positive rudder settings, which must aid the model's consistency.

The basic construction of my towhook and its associated components is shown in Figure 5 and should be self explanatory. Although the construction looks complicated, I make the hooks using hand tools only and the complete system takes only a few hours to make and in-

stall. The only critical items in the operation are that the movable glide turn arm spring should be stronger than the rudder torsion bar spring and that the rudder horn and attached spring are the right size and strength. A bit of experimentation with this spring length and strength may be necessary to get the system to function correctly. For a source of springs try a good old fashioned hardware store and ask for Terry's tension springs (or compression springs for the hook itself); alternatively try typewriter repair shops, or wind your own from 30 swg single strand control-line wire or other thin gauge piano wire.

Set the system up by installing the unlatched hook in the model, with the hook held in the forward position, i.e. the catapult launch mode, and then adjust the rudder line length such that the rudder is positioned midway between the straight tow and the glide settings. All the other settings should then be correct.

If you use a hook with an adjustable unlatch tension, set the tension at about 3lb for initial flights; a spring balance can be handy here, until the correct rudder setting for the catapult launch is found. If the unlatch tension isn't variable, take great care on the first few releases, since the model will be flying very fast when the unlatch tension is achieved.

Start the trimming by ensuring that the catapult rudder setting is roughly correct; this will give you great confidence should you have to do an emergency release when trying to circle. Simply tow the model up without attempting to circle, and accelerate the model by running rapidly into wind when at about 2/3 full height, adjust this rudder setting until the model peels off gently into its glide turn as the latch releases. Figure 6

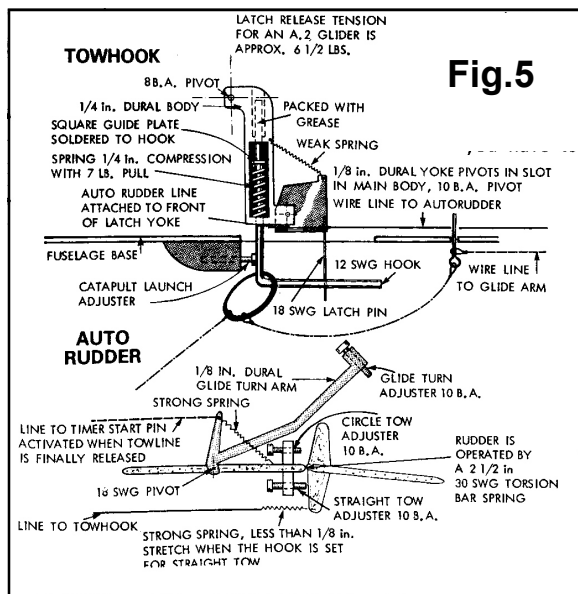
The next stage is the first circle which is always the hardest. Keeping 30 or 40 feet of line on the winch drum, tow the model gently until it is above you or just ahead of you. (**NB Towing with the line attached to the winch is now prohibited for safety reasons. Doing so may invalidate your BMFA insurance**) If the line starts to go slack before the model reaches you, either run a little faster or wind in some more tow line, which will ensure that the rudder stays in the straight tow position. When the model is in front of you, let the line go slack and run downwind, paying out the spare line from the winch as you go, ensuring that the line remains slack. Try to watch the model as you go downwind and try not to let the line tangle in the undergrowth that obstructs the average flying field.

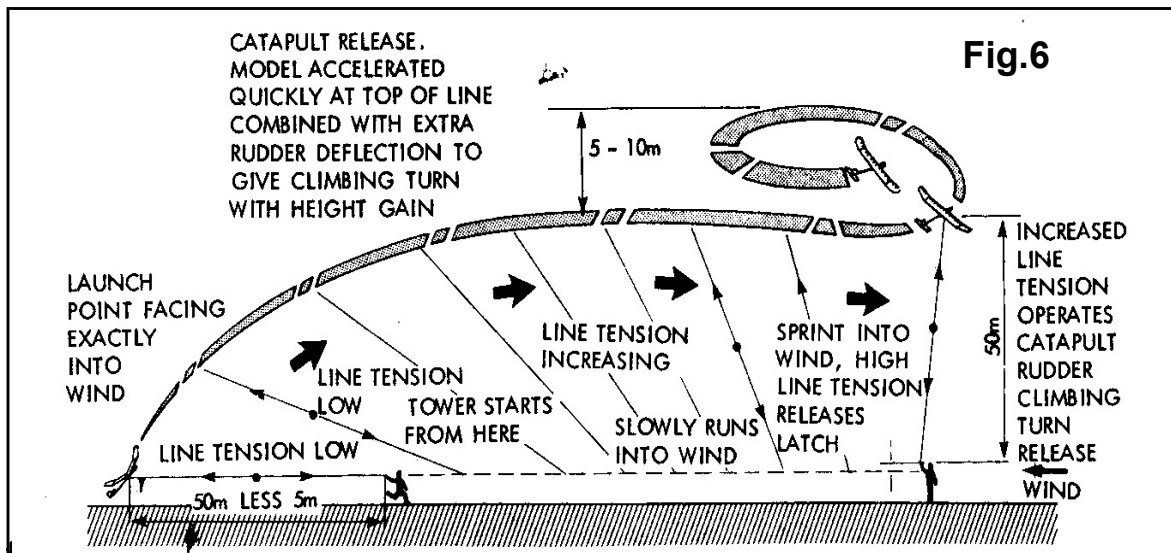
The model should have started to turn as soon as the line went slack and should do a fairly tight circuit, such that as it comes into wind again you are just upwind of the model. By then running fairly rapidly into wind and increasing topline tension you will release the latch and release the model to glide normally. Alternatively you can gently tow the model into wind again until it goes in front of you, to do further circuits. If you wish to do consecutive circles on tow you should aim to be just downwind of the model as it completes each circuit and by keeping the line slack the model will carry out another circuit. Figure 7.

The ideal towing flight pattern for circle tow is when a model begins its first circle with the imaginary centre directly above, or slightly up wind of the tower, Figure 7. The model should be towed with light tension on the line until overhead just upwind of the tower, where the line tension is then reduced so that the line is slack and the rudder moves to circle. Set off downwind, so that as the model completes its first circuit and comes into wind again, you are still just downwind of the model allowing further circuits. In this way the model is always circling on a slack line and you should be able to judge (by the degree of slackness and altitude) whether the model is in lift or not.

If the model starts circling when it is still down or even side wind (towards the glide turn) of you, as can happen in windy weather or with a badly trimmed model, then the model will probably be flying on a tight line all the time, and this makes lift detection very difficult and can easily mean that the model crashes whilst still on tow, as the rudder straightens - very undesirable! Figure 8.

In breezy weather one circuit on tow is all that you will be able to achieve at a time, otherwise



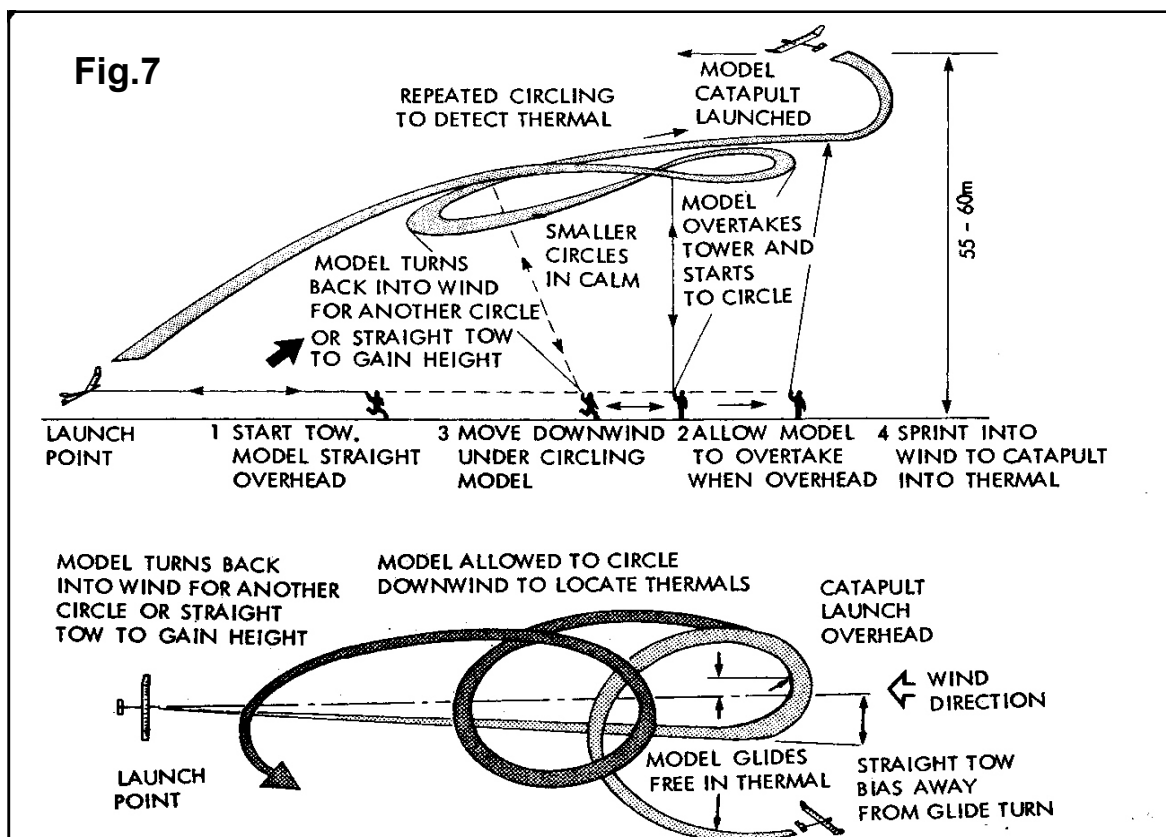


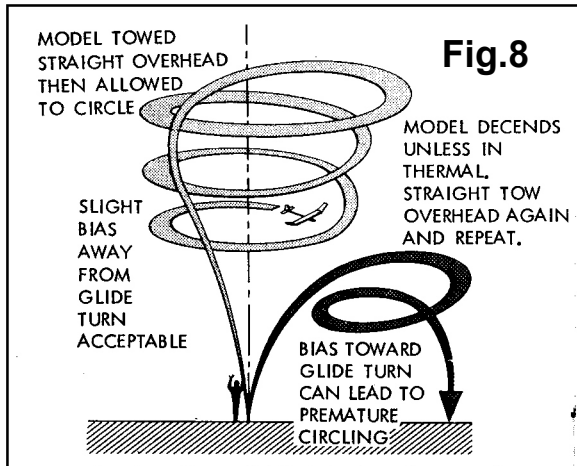
you will be halfway down the aerodrome when you release and your legs won't last the day. Unless the available lift is very weak, you shouldn't need to do consecutive circles on tow, since after practice you will be able to judge if the lift is present during just one circuit.

The common faults that beset circle tow models are: models that remain resolutely pointing into wind when the line is allowed to go slack, refusing to circle, or models that complete the first half of the circle correctly and then head straight off downwind until the towline goes tight where upon the model tries to dig its own grave. Both

these symptoms are caused by the same fault or series of faults in the model.

The easiest starting point is to try moving the hook forward by up to 1/8in from the ideal straight tow position. This will give you a slightly weavy straight tow but since the model won't generally be used in windy weather this can be tolerated. As mentioned earlier, moving the hook position is rather a fiddly job since it necessitates moving the hook pivot and replacing (or altering the length of) the line from the hook to rudder.





Hence some of my models are constructed with 1/4in sq of brass shim at the hook bend which can be filed away to move the effective hook position forwards. If altering the towhook position doesn't work, then the cure involves juggling the wing warps or relative incidences. Again this is where the twin wire wing fixing comes into its own. To make the model begin its circle tow or to keep it circling on tow, you will need to increase the incidence of the inboard wing relative to the outboard wing. If your model has a wing joined as above, you can experiment with different settings on the field. If you can't vary the relative incidences on the field, you will have to return home, steam in some different wing warps and try again. A little too much differential incidence is better than not enough.

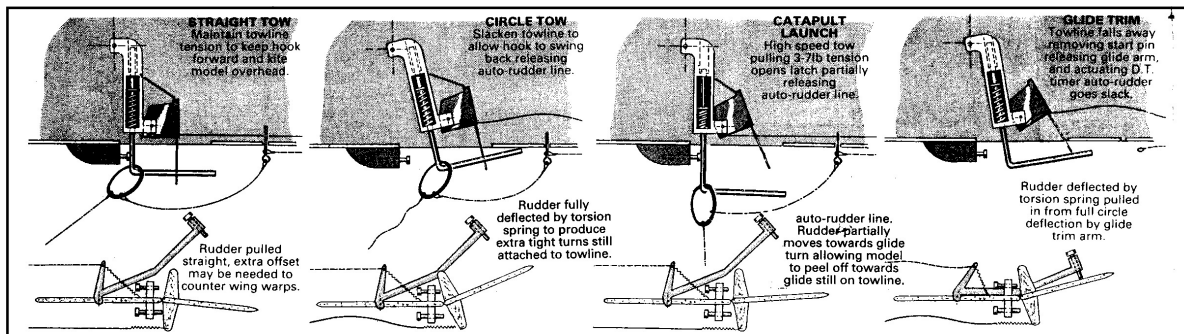
With the right amount of differential incidence, the model will tend to turn away from the glide turn direction just before it reaches the top of the line when being towed gently and will tend to turn into the glide direction when being towed rapidly, i.e. just before giving a catapult release. If the differential incidence is overdone, the model will try to turn sharply away from the glide turn direction just before going into circle tow; it may even begin to circle the wrong way and once the model has completed its circle on tow it will try to do a second circle, even when the line tension is applied again and the rudder has straightened.

The correct style of catapult launch is determined by your model design. If you have a model with a fairly thick under-cambered section, and a fairly well forward CG (50-55%) i.e. a typical British type of model, then you won't achieve a great height gain with the release, since the model's drag at high speed is so great that the model will tend to come off the top of the line and run out of steam fairly rapidly. This needs a catapult rudder setting nearly as great as the glide setting.

If however you have a Russian style model with a fairly thin, low cambered section and a fairly rearward CG, then the model's drag at high speed is comparatively low and you should be able to gain 20ft or more of altitude if you give a good release. This only requires a very slight rudder deflection upon release but such a model can give problems, since just after release from the line the rudder will go to the glide setting and this, combined with the high speed, can give spiralling problems. This is why the Russians use ailerons or delayed timer operated rudders on their models. Personally I consider that the British style model will give the better performance for the smaller amount of effort that the average modeller is prepared to devote to his sport.

A couple of final tips that although not connected with trimming should assist in successful flying. Never let your towline go tight when the model is heading downwind away from you since the model will nearly always crash. In such an attitude the rudder will return to the straight position and hence the model won't try to turn out of trouble. The only way to stop the rudder going to the straight position when the model is in such an attitude, is to use a system with the hook pivot directly above the hook position; which gives considerable problems in getting the model to the top of the line, as explained by Martin Dilly in the January 1979 Aeromodeller Free Flight Scene.

Use your winch properly to save your legs; by winching in and paying out towline at the correct moments you can gain considerable extra con-



trol over the model. If you can't get the model to go overhead, prior to circling, in calm weather, winch some line in and your model will accelerate forwards. **(NB the earlier comments on winch towing no longer being allowed.)** The reduced effective line length won't matter since you are not going to release the model at that time. If the model is heading downwind away from you, payout some spare line; this certainly saves your feet and may save the model. In about a 5 mph wind you should be able to stand

still indefinitely and just control the model using the winch.

I have covered most of the problems that I have encountered during my eight years of glider flying, although I must confess to still having one model which despite frequent trimming sessions still won't tow properly. If anyone knows any other cures not mentioned, please let me know, preferably before I compete at the forthcoming World Championships.

The following piece by Andy Crisp on flying in typically British conditions comes as a result of a lot of experience and wins in conditions that would deter many of us. It appeared in a BMFA Free Flight Forum Report.

HOW TO FLY GLIDERS IN HIGH WINDS

by Andrew Crisp

This season a number of our major competitions (Nationals, etc) have been blessed with fearfully high winds. It seems strange that aeromodelling literature is often concerned with ways to produce the ultimate still air machine, when in reality, certainly in a country like Britain, one might be better off developing models, and an attitude, which allow you to succeed in conditions that are considerably less than perfect, i.e. high winds, turbulence and rain!

Here are some thoughts to make you competitive in a gale:

1. If you don't fly you don't win.
2. It's a duration contest and not a concours d'elegance. Never mind the state of the model, it's the score on the card that counts.
3. In inclement conditions there's a strong likelihood that you will lose aeroplanes. It's better to fly a "dog" with which you do not have much involvement than your precious "super-doooper" affair,
4. If you really want to win in GB, given the conditions that we so often get, why have a typical set of gliders - say three typical modern FIAs, one or two state-of-the-art still air ships (have you got that promised bunter yet?) and the aforementioned dog? Why not have three such models? These are the ones you are most likely to break, lose, etc.

REQUIREMENTS OF A ROUGH WEATHER F1A

- a) You should be absolutely familiar with its quirks, i.e. it needs to be well flown.

b). It should be strong, yet not vastly over weight. To this end a compact layout helps.

c) It should be rigid enough to withstand flight loads yet spring apart easily on a hard landing, e.g. plug-in wings don't have to have loads of masking tape or rubber bands to stop them falling off in flight!

Reinforce the stab L.E. with thin ply where it sits on the fuselage tail mount. Attaching the stab with good 'ole rubber bands seems more sensible than the fancy "drag-free" spring fittings sometimes seen.

d). It should have circle tow. In the sort of winds we are talking about (10-20 m/sec) deliberate circling would be most unwise, but the catapult facility should allow a clean turn off into the glide circle with, hopefully, some height gain - much better than a big stall from a "straight" tow. Lack of experience prevents me from commenting on "bunt" releases in these conditions! You may be in a situation, even in a contest with decent weather, where you are forced to use your rough weather job as a last resort, then you will be glad of its circle tow facility.

If you are worried about the extra strain on the wings given by the tension necessary to open the catch, as well as the strain from the high wind, then either make stronger wings or tow with the catch open and the timer started. You're probably going to release as soon as you get to the top of the line and in a very high wind that won't take very long!

e). Use a sensible colour scheme on the model which is visible at great distances in the air and can be picked up easily on the ground. Obviously, if you can afford a Biotrack system, long distance retrieval should be made a lot easier.

THE FLYING

If the competition is in rounds fly reasonably early. If you crash a model on tow it might be possible to repair it, or better yet, get the reserve into play.

Use a trusted helper to launch for you. My system, for what it's worth, is to say "OK" when the time is judged right to fly. The assistant raises the model from its shielded position to the launch position. Then "GO!". He or she releases the model and you start running towards it like crazy!. Start with about half the full line out, and wear a stout glove to allow it to slip through without cutting your hand. Gardening gloves are very useful.

Try to get the model to the top of the line as smoothly as possible. If there is a jerk when the end loop or pennant hits your hand, it could open the latch and bring in the catapult rudder sooner than wanted, with dire consequences, e.g. a sharp swing towards the ground - possibly tarmac - when you have to make a very hasty decision. Either you plant the model and get

another attempt or throw the line and get a low release for a poor flight.

If you do get the model to the top of the line without mishap, don't even contemplate circling to check the lift you thought you'd detected on the ground. Make as decent a launch as you can, straight away before you get into trouble - turbulence induced weaving, etc - and hope for the best!

If you throw the line, as I do, retrieve it without delay before it trips somebody up. In a gale it can drift quite a long way downwind. Return to the timekeeper, who should be looking after the winch, and rewind the line. It is not advisable to put your winch in a pocket. etc. when towing in a high wind. If you trip you can do yourself and the winch considerable damage.

With the timekeeper(s) watch the flight to its termination - to the ground or O.O.S. - so that you have at least two opinions on the model's bearing. Thank the timekeeper for his efforts; then go and retrieve as best you can!

The next article, also by Andy Crisp and also from a BMFA Free Flight Forum Report of the early 1990s, covers the principles of circle towing in depth. While some of the items mentioned, for instance the Schmidt towhook and Dayglo Stren monofilament, may not now be available current substitutes exist.

MY WAY WITH GLIDERS

by Andy Crisp

This is supposed to be an experts' forum, but the glider expert won't learn a lot from what I am going to say. This talk is aimed at the interested beginner, the sports flyer wanting to break into competition flying, or the competent rubber or power flyer who might wish to do the same.

Before I get going, I should like to mention and acknowledge the presence here of two of my aeromodelling heroes or gurus, Mike Fantham, our current F1A World Champion, whose models always seem perfectly adjusted and who has the ability to pick lift out of nowhere, and John O'Donnell, who, in his time, has written more good sense about model flying than all the rest of us put together.

Although this talk is about contest flying, it could apply to anyone who wants to get a glider to go as well as possible.

I am involved in quite a few 'leisure' (I hate that word) pursuits, nay, obsessions, - running, fishing, drumming, aeromodelling etc. but all seem to have a common thread if you want success, - preparation, practice and intelligent use of your experience. Remember the words of the great Bob White in his definitive article "What to do When the Dope Dries" (NFFS Symposium, 1988). In summary he lists five salient points, three of which are "practice".

To win you need attitude. You can beat half the entry in any given contest on attitude alone. Many people don't actually want to win enough. They are there for other reasons which are good enough, I suppose, in their own right - 'getting away from the wife, husband, kids, gardening etc., etc. They like to participate, like to be involved with competitive creations, i.e. performance airplanes, which are obviously removed from sport or radio jobs. We can all get hold of the plans. Most of us can build OK, yet, bearing in mind that the majority of designs within a given class are quite similar, there is a great variation in performance when actually seen on the field.

Many involved in this game are what you might term middle-agers who have done quite well in life, who think they know best and who often have a pig-headed resistance to the obvious when it is staring them in the face.

Typical examples might be the winning of the World Glider Championships by the Russians in 1961, '73 and '75 (not forgetting second in '57 and '59) when we were saying "You can't beat a Rolling Stone (or whatever)". Or, perhaps having invented delayed prop release in this country, to sit back and watch Andriukov and Co. take full advantage of the idea.

I'm not going to talk much about design and construction. That has been covered before. What I am going to emphasise is setting up and storage.

At the last major contest I attended parked near to me was a flyer whose aspirations seem higher than his placings. In between flights the models were taken apart and just slung in the back of the car - the tail among the sandwiches, the binoculars over the fuselage boom and so on. Perhaps these little things add up to remarks like "That's funny, it didn't stall out of lift last time I flew it".

Following the example of Paul Lagan, whose models I proxy flew in 1967, I always rubber band the wing panels lightly together - always with the same wing on top. The stab is then banded to this package, always the same way round. The whole lot stands on a leading edge. Models are kept like this between flights or in storage at home. Cars can get very hot on the flying field so it's a good idea to open the windows a little and the tailgate to allow a through passage of air.

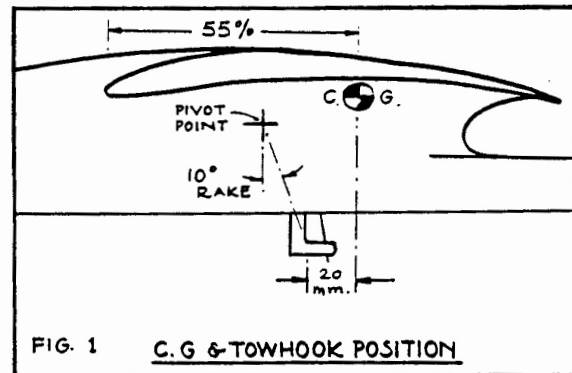
SETTING UP

Take some time over this in the workshop and you'll have less to do on the field. All you've got to worry about at home are warps, c. g. and rudder positions. The incidence takes care of itself (by packing or screw adjustment) on the field. Warps - I like to have my centre panels flat and confine the differential twist to the tips. This makes things easier to check - flat is flat! I'm quite prepared to re-warp after testing if something's not right - good old steam from the kettle and twist. This seems to work as well as any with "traditional" structures, but I can't speak for the predominantly carbon "hi-tech" style.

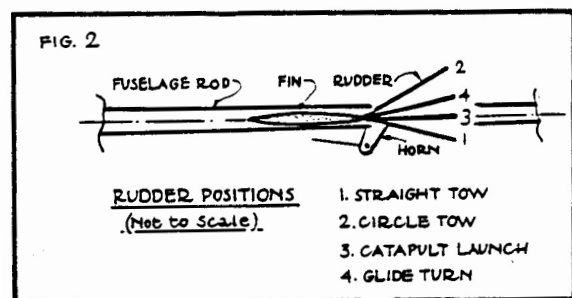
Unless you insist upon deviating from the standard modern glider layout, the c. g. is likely to be between 50 and 55%. Take care not to go be-

yond where you intend it to be. It is better to go overweight to get the c. g. in the correct place than to try to 'trim it out' with the c.g. too far back ..

The towhook should be installed with great regard to its position relative to the c.g. In its forward (i.e. straight tow) position it should be 15-20 mm in front of the c.g. Generally speaking, with the high aspect ratios on wings used today the hook position for straight tow does not seem that critical (Fig.1).



To save weight at the back end, I do away with quadrants and other rudder position measuring devices and just ascertain the rudder's position by eye relative to the boom, looking from above. With, say, 2 or 3 mm differential warp for a right hand glide you should need approximately 2 mm left rudder for straight tow, 7 mm right for circle tow and 3 mm for the glide. Catapult launch might need 1 mm bias to the right from the straight tow position. These settings are not absolute, and, of course, will depend on the size of your rudder relative to the total fin area, but should give you reasonable starting points (Fig.2).



(It should be noted that since this talk was given a definitive article by Peter Allnut of Canada on rudder positions for F1A gliders has appeared in Free Flight News, May 1994.)

To anyone who has not flown a circle tow glider before all this may sound a little daunting, but it is all possible and quite easily installed using the

cheap Schmidt hook available from Free Flight News. I am sure the Woodhouse products are equally suitable! Finally make sure that your timer start from the towhook latch is 100% reliable.

THE FLYING

For years the typical flying instruction for a kit or plan went something like this. "Make sure there are no warps. Make sure that the c.g. is in the right place. Test glide on a calm day over long grass. If it stalls pack up the leading edge of the tail. If it dives pack up the trailing edge". If you were lucky it might say something about towing. "If it weaves move the hook back.. If it pulls over to one side, move it forward".

All good advice to a point, but there must be more in it than that, otherwise everyone's model would be flying perfectly, and, as can be seen by a visit to any model meeting, this is sadly not the case!

I like to go out trimming alone, or with just one helper. Too many opinions confuse the issue and stop you concentrating. Of course the day is calm and the grass long! Lock out the D/T and make a few test glides to make sure that nothing is vastly wrong and that there is a perceptible right turn. I will assume throughout this diatribe that your model glides to the right. There is no logical reason for this and several famous flyers - Lepp, Drew et al, favour a left turn. What you must NOT do is have some of your fleet turning left and some right. There will be total confusion when a reserve model is suddenly called upon during a contest.

Pack or adjust screws where necessary to get the glide relatively near the stall. I'm still a firm believer in glued-on packing which is tangible as compared to screw adjusters (and, I believe, lighter), although the engineers amongst you will disagree.

Now let's sort out the glide properly from a bit of height. Set the D/T for quite a long time, say two minutes, and try a tow on a short (20 metre) line with the latch open and the timer running. Tow up and float the model off. By doing this you don't have to worry about recovery from catapult launch, etc. It's only the glide we're concerned about now. Repeat several times and have a really good look at the glide. Adjust the tail incidence to get as slow a descent as possible without actually stalling or mushing.

Aim for a reasonably large glide circle. It is more convenient to quote the circle size in terms of time taken rather than physical diameter. Thirty

seconds might be a starting point. This is of course in calm. In wind and thermals circle time can vary greatly. It is also related to fin size and dihedral. In still conditions a large circle diameter can be advantageous, but makes recovery more critical from a catapult launch. Of course we now know that the "bunt" launch is the answer to this.

We hope the model is going to have to D/T a lot in its life, so the next step is to sort this out. Still with the latch open and the timer running but set short, say 30 seconds, tow up to height on a full length line. Note carefully what happens when the D/T operates.

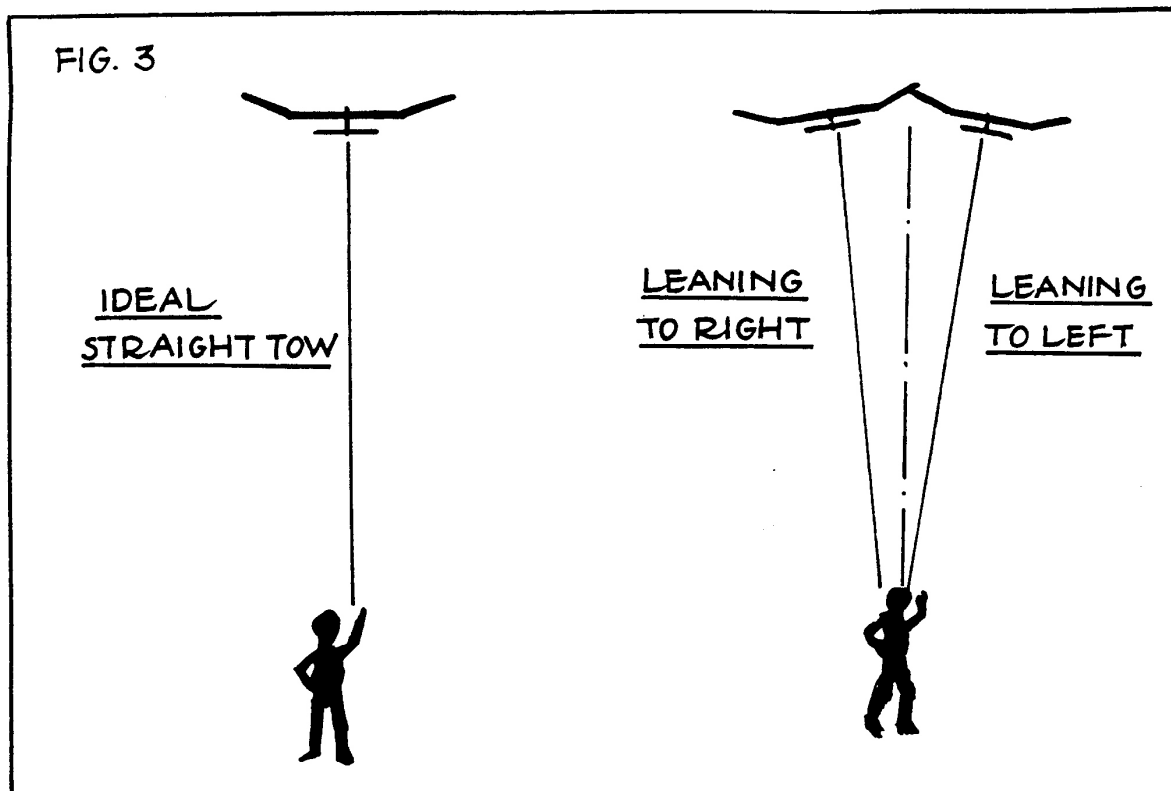
In my opinion, although others might disagree, it should descend flat and level, like most other types of free flight model on D/T. But, for reasons too complex to go into here, gliders and, in particular, F1As with their small tailplanes, tend to spiral down. This in itself is not bad. It is just a matter of degree. Make the tip-up angle easily adjustable on your model. If the descent is too steep, i.e. virtually a spiral dive, increase the negative angle of the tail. The worst thing that can happen is the dreaded flat spin. This is where the model goes into a "helicopter" condition and then, horror of horrors, combines it with a falling leaf motion. If the model, or more particularly the wing tips, survive the landing (despite your soft grass) the remedy is less D/T angle on the tail. Generally speaking, I have found that the higher the aspect ratio of the model, the more critical is the D/T angle. Complete underfins help a la Lepp and Gewain, but of course pose other problems with some of the surfaces we have to fly on.

Now still with the latch open, and with a short D/T, we can concentrate on getting the straight tow made correct.

Contrary to some, I like my models to hang very slightly to the right. This can give an over tight catapult launch, but it is better in wind if you want to launch from straight tow rather than risk a circle. Conversely, if your model hangs left, more height can be gained as it swings across from the circle with the zoom rudder coming in (Fig.3). I should add at this point that I have no bunting experience (certainly planned for the future), so all this refers to conventional catapult launch.

THE BIG ONE!

By this I mean the first circle tow and catapult release! I still see, in this country, flyers who were quite good with the old straight tow mod-



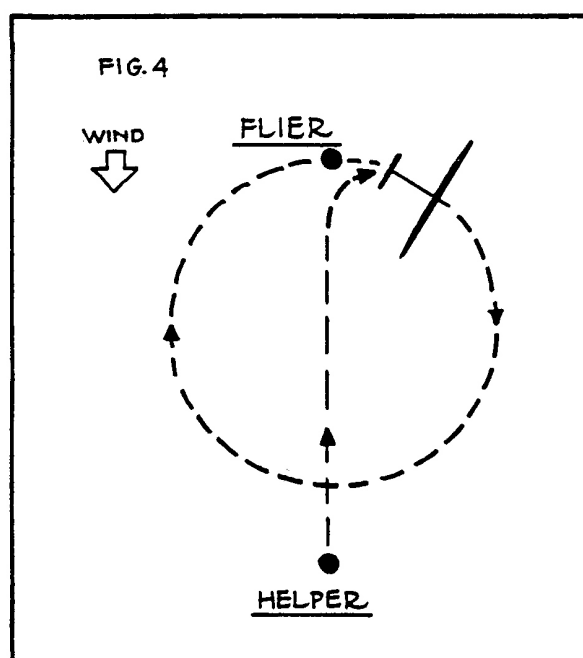
els, but who have never got to grips with "circling". They are too gentle with the models, they make panic early releases, they lack confidence to manoeuvre into advantageous positions. If your model is designed and built properly, it should take all you can give it without falling apart. Your major problem will be bending wing dowels, especially if you use British model shop piano wire!

Perhaps at this point I should mention towlines. For years I swore by Elton Drew braided Dacron, perhaps as a throwback to my impulse release hook days. In the last two seasons, however, I have changed to a 60 lb. test Dayglo "Stren" type line, which although more stretchy, is tougher, more visible and can be dragged about through grass and thistles without tangling, especially when wet. To avoid the line being too spring-like when wound up I use a very large diameter winch.

It is amazing how latch tensions have gone up over the years. In the early '70's when circle tow took off people talked of 3 lb (1.5kg) tension. Now 121b (6kg) is common, particularly with bunt release. I use 7-8 lb, i.e. the maximum available on a Schmidt hook.

OK! Tow the model up with latch engaged and with very short D/T to bring it down safely if it gets into any trouble. Let's assume a light 5mph (2m/sec) breeze. When it gets to its full height,

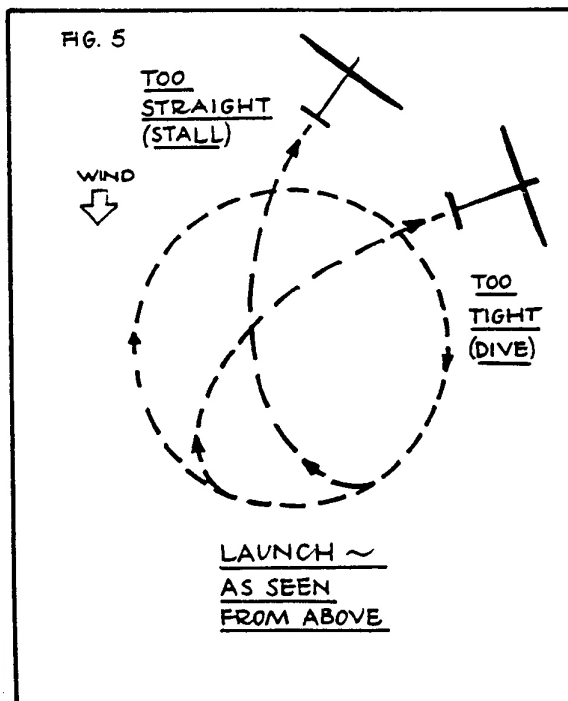
slacken off. The model will turn right and start to go downwind. Trot after it keeping the line slack. It should circle round naturally and then straighten up with increased line tension and go to the top of the line again. Repeat this over and over until you feel confident to launch. It is assumed that your hook system allows more rudder for circling. This should be quite a bit tighter than the glide circle, but not so tight that the model starts to spiral in on the line. A tight tow



circle is fine in a strong wind, but in my opinion, some people fly too tight and lack the sensitivity for finding light patches of lift.

So your model is up there behaving nicely. You think you have found a nice patch of rising air. Let's launch! Allow the model to come round the bottom of the circle. Straighten up with tension and RUN. As the model accelerates to the top of the line you should hear a "click" as the latch opens. Pull down on the line and jump up to release it. The tension should shoot the model away from you, with the line falling free as the model, hopefully, gains several metres of height in a climbing turn. This, of course, is the ideal situation. Actuality may be different! (Fig.4)

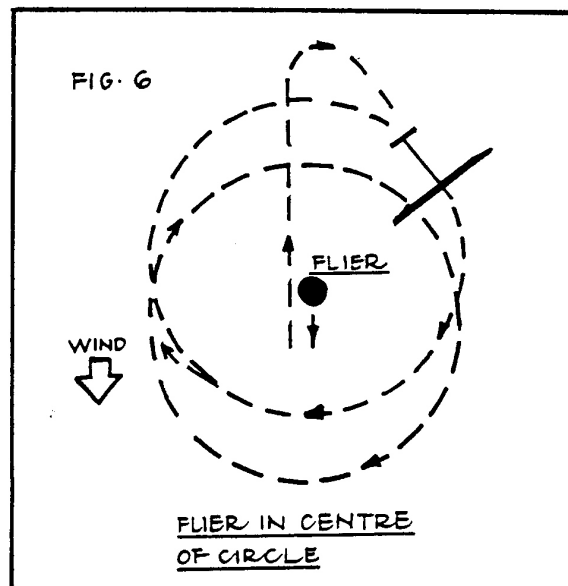
The model may fail to unlatch. Don't be so faint-hearted. Pull harder! The model may stall on release. Perhaps there is insufficient catapult rudder - adjust if possible. You may be starting the acceleration too late and the model simply runs out of steam. From a bad stalled launch the model should recover into steady gliding flight after a few oscillations. If it doesn't you could tighten the glide turn slightly, de-elevate the tail, add an extra turbulator to the wing or in extreme cases the tail. There are many possibilities which mean many "training flights" so you need to be persistent and fit!



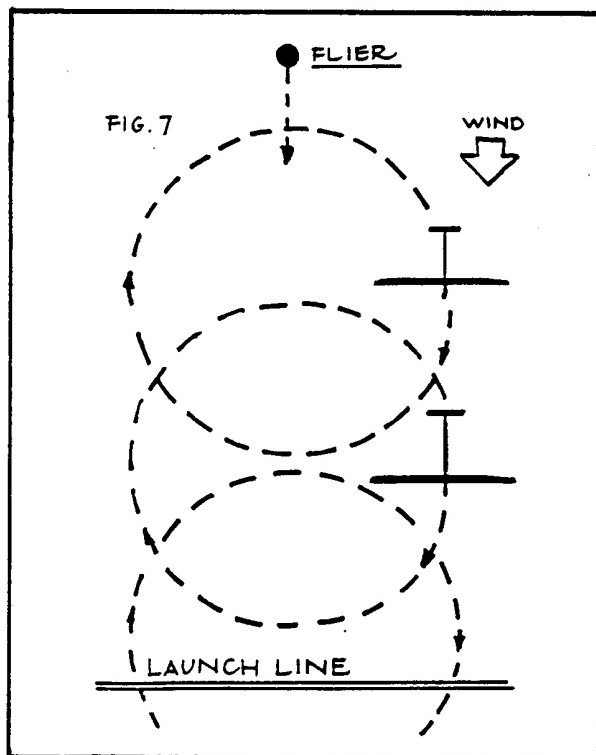
Should the model bank excessively over to the right on a hard launch it could mean that the extra rudder is coming in too early. So start your acceleration a little later. Excessive turn can

also occur if you swing round from the bottom of the circle without slowing things down for the straight part of the tow (Fig.5). Remedies are to increase unlatch tension (if possible) or to trade in some right glide setting rudder for right tail tilt. If you can cope with the added complication, a delayed rudder facility should help. In bad cases it might be necessary to increase the warp differential of the wings.

So - now you can make the model glide, circle on the line and do a reasonable launch. Let's now explore some of the advantages that circle tow can give you. The rules in this country state that, for safety reasons, you must detach the line from the winch while towing. This can give great mobility to the flyer and a great help to self launching. You lay the line out on the ground, hold the model in one hand and grip the line with the other. Run forward and release the model. Let it rise to about 10 metres. Slacken off. The model should turn away, but you keep moving forward. Straighten up, repeat the procedure as required and the model should be at the top of the line, you only having run 30 metres or so.



A further energy saving technique in light to moderate air is to let the model fly in front of you so that you remain in the centre of the circle, rather than being on the upwind side, as it were (Fig.6). Tow the model to the top of the line and pull down gently but firmly with an overhand movement. The model should go in front of you and will probably veer slightly to the left. This is due to the rolling effect induced by the wing warps now that the model is horizontal and being speeded forward. Now slacken off and if there is any appreciable wind move downwind with it (Fig.7).



The model should remain circling over you. One can save energy and do away with a lot of racing about in this way. In stronger winds this technique still works but you have to anticipate and become quite fleet of foot to prevent line tension getting to unlatch levels. For rough weather flying, especially when using a Stren-type line, I recommend that a glove is worn on your towing hand to prevent cut or burnt fingers.

Another mobility advantage of circle tow is to fly tactically. i.e. pinch someone else's lift! A model upwind is in an obvious thermal. Anticipate its direction. Tow up and wait for it to pass over. Circle to check the air. If it's obviously rising, line yourself up and go for it. If you have some doubt continue circling and wait for the next one, or go and find your own thermal.

Most worthwhile glider contests these days are flown from a line and the really big ones from a position on that line. Confident mobility in your circle towing is a great help here. You can wait on the line (if round time allows) and wait for something to come over - very rare these days, and besides it's really boring! You can tow away to your secret corner of the field where no one can pinch the beautiful thermal you're going to find, or you can work your way downwind of the line where you can find your own thermal or take advantage of anything that comes up in front of you.

Sometimes in calm weather it is difficult actually to move downwind of the line. Here's a trick to

enable you to do it. Layout the line but hold it about 3/4 of the way up. Tow the model until it is about 45 degrees away from you. Deliberately induce a stall on the line. The model should drop its nose and head off downwind. Do this a few times and you should end up in an advantageous position.

The trouble with all this stunting about, what with other fliers up to the same game, is line crossing. A crossed line can mean a crashed model or a unwanted release and consequent poor flight. I prefer to tow where the air traffic is least, and when the time comes, make the best launch I can without colliding with other distracting models.

PRACTICE

I once went to a country show where some big names from the show jumping world were competing. Instead of going straight into the ring and doing their thing, as I imagined, they worked out and worked out in the practice area, so that by the time their number was called, they just flowed into action.

And so it should be in glider flying. If the weather is half reasonable, get out and practice before the contest and between rounds. Find out what kind of pull it takes on the day to indicate a thermal. Sometimes the slightest tug turns out to be a real trash mover. Sometimes rising air seems to cover a large area, other times the thermals are small and short-lived. In practice you can afford to experiment and make mistakes. Practice mobility. Try moving crosswind to the right or left.

If it's calm, try to reach a particular spot on the field, then work your way back, circling all the while. Mobility and knowing what to look for gives you added confidence for the actual contest flights.

For really big events like World or European Championships or World Cup contests a "runner" is a great help. He or she should stay with you as you tow, be relatively silent (you should make the decision when to launch), but be ever ready to untangle line, which with the best will in the world, seems to get tangled round your legs, and to point out obvious models in lift which you may not have seen.

Finally, remember the Californian glider flier Jim Wilson's dictum. "Always finish any practice session with a good flight"! Putting words in action, I was out on Boxing Day, 1993 trying to get that launch right. After a series of 2:40's in the gathering gloom, I hit a little something after a good zoom and D/T'd at 3:43. Wonderful!

This article by 2007 World F1A Champion Per Findahl of Sweden brings us up to date on circle towing techniques and was translated by Ronald Borg.

ALL ABOUT FLYING F1A WITH A CIRCLE TOW HOOK

by Per Findahl

F1A CIRCLE TOWING

The surest way for an F1A flyer to be sure to find his way in the random world of thermals, is to fly with a circle tow hook. This hook makes it possible for the flyer to have a contact with the model during the thermal search. The flyer can move about on the flying field with the model trailing behind like a kite and thus study its behaviour and feel changes in line tension, which makes it possible to be surer to release the model in a possible thermal. The model is released by strong pull on the line, which in turn opens the spring loaded tow hook and allows the model to fly freely. This way of flying opens many possibilities, but also puts demands on the flyer and his equipment. Much more training is required to be able to control the model during the towing in all thinkable and unthinkable situations.

THE FIRST ATTEMPTS TO FLY WITH CIRCLE TOW HOOK

The first tries to fly with circle tow hook are best carried out in a weak wind, with no thermals. The basic trimming is carried out in exactly the same way as with a model with a straight fixed tow hook. The model should track straight when towed up on the line and should fly in circles of about 30 seconds after release without stalling or diving tendencies. After having achieved this you should look at the two functions that your new model has. It is equipped with a circle tow rudder position, meaning that it flies with more rudder deflection than it does when it flies free. It also has a specific rudder position during the release moment or when the hook is unlatched. See next section.

MORE FUNCTIONS BUILT IN

The hook has a rudder zoom function position as mentioned above. The zoom rudder function starts to function at high speed during the unlatching of the hook or release of the model from the towline. During this phase the rudder helps the model to turn weakly or to transition into the turn direction during the glide phase; this helps to get a nice transition into the glide phase after release. This opens up lots of possible trim possibilities (See trim tips).

Circle tow hook flying therefore offers lots of possibilities to find thermals, but it also requires the flier to fully master the technique in order to fully

utilize it. Two important things must be trained in order to achieve this goal:

- 1) Full control of the model on the towline in all situations.
- 2) To be able to recognize how the model behaves on the line when it goes into a thermal in conditions with no wind, or winds up to 9 m/sec.

SOME GOOD TRAINING TIPS IN ORDER TO BECOME A GOOD CIRCLE TOW HOOK FLYER

The most important thing when you start circle tow hook flying is to feel that you have full control of the procedure. The tow line should have a loop where you hold the end of the line, which enables you to feel the end of the line. Do not have heavy things at the end like a winch. This can cause disqualifying if you have to release the line for some crisis reason. Half heavy things like indoor hockey plastic balls can be helpful and are allowed by the rules, but can usually cause catastrophes, as they easily catch round things and get stuck. A small loop is best. It can glide easily on the ground and affords a good grip for your hand during the release phase. It is hard to keep track of the line during the first attempts to circle tow. It is therefore advisable to carry out these in a weak wind. You let out the line and remove it from your winch, your helper holds the model and you hold the tow end of the line.

You tow up the model in the usual way, but when the model is overhead let the line get some slack. This will allow the model to turn (with rudder in circle tow hook position) and you must now use your legs to keep up the slack in the line, but when the model has made nearly a full turn you can take up the slack and tow the model up again. Observe if the model needs more or less rudder deflection to circle tow easily.

KEEP TRACK OF THE LINE

At the first tries you should be ready to release the line if you are in a crisis situation; it is therefore good if you easily can let go, like just opening your hand. Avoid getting entangled in the line so that it hinders your release from your hand! Exercise this before you put all attention on the release phase. Take down the model with the line attached rather than to try to pull the model out of an uncontrolled situation. Exercise to find the correct timing when to start pulling up the model after a completed circle tow turn. Some models can be pulled earlier than others which have to be waited in on more. When you feel that you

have control of the technique you can try to unlatch the hook to release the model. Here you have to consider what type of model you are flying. A composite model can be pulled harder, while a wood model must be handled more carefully in order not to break the wings.

TIME TO MAKE A CIRCLE TOW START

Let the model take a high circle tow turn. Check that the line is fully out, and start to pull the model in the same position where you earlier finished a circle tow turn. The model will now accelerate, and the zoom rudder will start to turn the model slightly in the direction of the free flight turn. When the model is nearly overhead, let go of the line with a simultaneous slight pull first; the model should complete a climbing turn and transition into the gliding phase. To trim the unlatching phase so that it works perfectly every time is the most complicated part to achieve on your model, see trim tips for more info.

MOVING ABOUT WITH THE MODEL ON THE TOW LINE

The next step is to try to come back to the same place where you were when you started the previous circle tow. It is an important part in order to feel confident as a circle tow flyer. You tow up the model circle tow and run, with the goal to get back to the point where you started. Vary the training by moving sideways, by pulling the model far into the wind. One can imagine that you move from a centre point (starting point) in all possible directions, but the goal is to return to the centre point after a completed circle tow. With your present circle tow technique it will be very physically demanding and it therefore leads us automatically to the next training phase.

TAKE UP SLACK IN THE TOW LINE INSTEAD OF EXHAUSTING YOURSELF!

A well trained circle tow flyer does not use his legs so much during the circle tow phase. One can save a lot of strength by letting the tow line do the job! This can be best explained by the flyer taking up slack in the line instead of running to tow the model up. In this way one can complete a circle tow turn without the need to run so much. It is very important to be able to master this method. You can more easily concentrate on the thermal hunting and most important you save your strength at a contest occasion. The method is carried out in the following way. Tow up the model in the usual way, and when the model is halfway slow down the running speed to walking and start at the same time to haul in the tow line with both hands. It is easiest to do this if you let go of the loop and letting it lie freely on the ground. You are off course still holding on to the line with both hands, the line

can run freely through your hands. When the model reaches max height you should have about 5 meters of tow line lying on the ground. The model can now complete its circle without you having to do any running to keep up the slack in the line. You will have to concentrate to see when the line runs out and to adjust this so that the transition between circle tow and towing up again becomes smooth and not sort of panic. If you have too much line on the ground the model can start a new circle before you have time to tow up again, and if you have too small an amount of line on the ground this will result in a tow up too early, which can result in you pulling the model into the ground. See exercise 6.

SOME DIFFICULTIES YOU MUST BE ABLE TO MASTER

Taking up slack in the tow line must be carried out without it being entangled! Try to move somewhat while pulling in the line; this will make it easier to lay the line in a line beside you. If you stand still the line will fall around or on your feet and when you move you will be entangled with the line. Try to avoid objects on the ground that can get in contact with the tow line like twigs, bushes and high grass. When the line slack is running out when the model circles, let it run through both hands. Keep a distance of half a meter between hands; this gives you some readiness to handle the loop when it comes up. You must of course keep track of how much line you have lying on the ground but the short moment you have when the loop passes from your first hand to your second, makes a huge difference if you get into a panic situation or not. Use the earlier training point with a centre point which you move about with the new knowledge about taking in line on the ground. Try to learn to acquire the correct amount of line on the ground. It is never good to have too much line on the ground. There is always a risk that it will get caught up in something; it is also easier to feel the thermals with all the line out and it will take more time to an eventual release when you have a lot of line out on the ground.

FLY A COURSE WITH OBSTACLES

Vary your training by deciding on goals on the field that you move towards while circling. Try in the beginning to carry it out in a safe way, and then do it faster and faster. Make up a course on the field that requires you to go round in the fastest time possible, including some obstacles like forest grove and bushes that have to be passed. See exercise 7. Try to vary the exercises with different courses that can put your knowledge in model control into a new unforeseen situation.

CIRCLE TOW WITH OTHERS WITHOUT GETTING ENTANGLED

When you have got this far in your training it is good to carry out training flights together with some flying friends. During contests most obstacles are not solid obstacles but other contestants. To fly together is a very important training in order to get a good self confidence in a coming contest. You should be able to handle situations where you in principle are surrounded by 5-6 flyers and still focus on thermal hunting, and not get into a panic. Therefore train to fly together at the same time. Choose individual centre points that you circle around about 20 meters from each other and try to move towards it without flying into each others tow lines. See exercise 9.

MOVE TOWARDS EACH OTHER WHEN GETTING ENTANGLED WITH OTHER FLYERS

Do the same exercises with goals and courses on the field and do it together without circling into each other. To fly together raises the difficulty level substantially and puts your flying to the greatest test. You will master it; it all comes down to knowing how your model behaves in different situations! Train also to get out of crossed tow lines. It happens often in contest flying that two or more contestants get entangled in each other lines. Move towards each other. The worst thing one can do is to move away in different directions, it will result in at least one flyer getting his model pulled down to the ground. If you get close to each other, you can easily undo your tow lines and continue your thermal search.

TRAINING IN WIND

It is definitely best to learn your model's behaviour in weak winds, but when this has been done you must exercise in windy and turbulent condi-

tions. How many contests are carried out in calm conditions? The level of difficulty increases markedly with wind strength and even a very competent circle tow flyer can have great problems at wind velocities up to 9 m/sec. It is therefore very important to master your model in all possible weather conditions. Even rain weather is not considered a guilty reason to cancel a contest.

WHATEVER DOES NOT KILL YOU HARDENS YOU

Take the opportunity to train even under inhuman conditions! Whatever does not kill you hardens you! If you can control your model in winds up to 12 m/sec, the chances are much greater that you will be able to do it at 9 m/sec (maximum at a contest). If you have put in much time in training in high winds you will not be disturbed when competing in 9m/sec. The training methods can be similar to the earlier explained; the basic problems are still there. You must be able to circle tow with your model and return to the same starting spot and also be able to move quickly to other places on the field. Therefore train on this also in windy conditions.

EVERYTHING GOES FASTER WHEN THE WIND BLOWS.

Usually you get less time to execute most things when it is windy; it is therefore important that decisions are built into you and can be taken quickly, otherwise it will be too late for you. This can only be achieved by training and more training.

Good luck with your training!

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