# THE AUSTRALIAN HOMEBUILT SAILPLANE

***Editor: James Garay***

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## *Editorial*

### G'day!

Here we are yet again! Enjoy another issue of our newsletter. It's springtime on this side of the world and the weather conditions are somewhat improving but Melbourne weather will never be as good as Queensland's. Not so long ago my wife and I had a few weeks holiday in Caloundra on the Sunshine Coast, Queensland and I had the opportunity to visit some friends up in Noosa. The weather was even more so exceptional with good temperatures of 23 degrees most of the time and lots of sunshine.

While we were up there we found out that the weather was miserable in Melbourne and as soon as we were back at home, with the help Dr. Peter Champness, I started to work on this issue that you're reading now.

I'm very happy that the newsletter is pleasing every body. Keep sending your contributions in the form of articles of interest for every one. It is your newsletter and only you can make it what it is.

You will find a complete report about Malcolm Bennett's Super Woodstock on wing proof loading and you'll also find one by Peter Raphael (The Erudite) and the other by Dr. Peter Champness, both are giving a full detail on what happened the day of such an event. I was there and I can assure you that it was very impressive to see the wings bending when the load was applied (one tonne) = or 1.000 Kilograms.

The Erudite was in charge of measuring the deflection on one of the wings, and he did it in style and flair, manipulating the tape measure like a cheer leader....I can tell you! It's his trade mark, very well known around the world and he does it carefully...everything has to be perfect!

**Editor**
**James Garay**




*Address all correspondence to:*

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*Kings Park Victoria 3021*
*Australia*


*Inside This Issue*

# MAIL BOX

Dear James,

Nice to hear from you once again. I found the June issue of the AHS Magazine one of the best I've read on practical aviation matters.

I met Dr. Peter Champness at the CASA Forum on Saturday and found fellow traveler. I also cannot walk past a Clints or a 2-dollar shop without going in and buying something. Our torque requirements are so low that we do not need expensive Chrome Alloy tools and therefore have more of them, which is often beneficial.
Talking about wings. proof loading
Depending on who is in control, and their attitude, determines whether or not proof loading is a requirement or desirable for older gliders. My own experience after being forced to do the first one, and having done 4 others voluntarily, is that you can be certain that your glider (or ultra light etc.) will not fail up to your proof load figure say 4 or 5 G's. It entails a fair amount of work, setting up jigs loading sandbags, organizing helpers etc. and always some minor and maybe not so minor failures will occur. It is a good exercise and well worth the effort.
Mike Whitney of the AUF has a good easy to read and implement scheme for 95-10 ultra lights which does proof loading wings at +15 degrees x 25% and –15degrees x 50% chord followed by a 2G negative load at –12degrees. Tailplane is loaded and point load removed from one side to test asymmetric strength and rear fuselage torsional strength. Fin is also loaded separately and in some cases, pod and boom, a special jigging/loading arrangement test the boom and its integrity at the fuselage attachments. Having done all this you can rest assured that you could weather safely severe turbulence and enjoy normal aerobatics.

Safe happy Soaring
Keith Nolan

Dear James,

Thank you for sending the Newsletter. I am not sure when I last paid for the annual subscription so if the enclosed cheque is a duplicate payment, can you kindly return it.

I have an interesting garage sale in which two Motor Gliders are for sale.

The first is a Motor Falke in excellent order with fresh form 2. Four stroke Stamo motor; available to a good home for only $ 27.000.00.

Sel lauching glider with Rotax 477 incomplete. Copy or generic type single seat fuselage completed, empennage completed, all running gear installed. No instruments, no wings. Only $ 12.000.00 includes covered trailer. If you know of anyone looking for a well priced motor glider this could be the opportunity. Kind Regards. John Thirlwall.

Dear James,

I am sorry to read of Peter Champness mishap but it makes for interesting reading and a lot more people will have been checking the wheel nuts of their trailers by now.

The articles on flying wings are always a good read as are the workshop tips.

No one yet contacted me offering a mould (on loan) for a two seats tandem glider cockpit, but there is always some hope.

My friend Jerry Leach is also looking for a motorized sailplane. Hope everything OK your end. Keep up the good work. Yours sincerely Andre Maertens..

*Ed note. Andre, your sub is current until next year March-2004. On reference to your concern about no body have contacted you offering the mould for a two seat glider I must tell you that this situation is out of my will. I do not have mind power to be influential on the reader of this humble Newsletter. Please do not blame me, I understand your concern.. But....! What can I do?*

Dear James,

Please fin enclosed payment for subscription renewal. I have made a start on the S-2A, mainly spending time poring over the plans and manuals to get a firm grasp on the building plan. Hope to actually start on the tools soon. Kind regards M. Habner.

Dear James,

I wish to re-subscribe to the AHS Newsletter. Please find cheque for two year subs .Lindsay Olen.

Dear James,

Thank you for the renewal notification. My renewal for AHS is on its way to Down Under.

Last issue # 29 " Launching into thermals" by Allan Ash are most adequate in the real world.
I made a take off, just as the wind increased from 10 to 20 knots and found myself in a sink down draught condition after passing the end of the runway. As the terrain climbs faster I did make a turn back.

Andre Maertens letter in the mail box section of the newsletter asked for Fauvel's plans. Well there is a Fauvel motorglider in Sweden, which is a homebuilt as well.

Plans are not longer available. But you can ask to the people who built one of them. As far as I know SE-XSL is one of a kind in Sweden.

I am also looking forward to see the test flight report on the TeST-3 Alpin TM self launching sailplane from the Czech Republic.

Wood and GRP seem to be a good solution, anyway. The TeST-10M is now under test flight in Czechoslovakia. It is an Ultra light Sailplane with an L/D 40:1

I found a way to calculate the ellipse factor, within reasonable tolerance. It will be soon included in my aerodynamic program.
I am out in the Internet for patent pended solutions of vortex reducing devices. Bird experts are probably at the frontline with wing tip finger solutions.

A model Jet engine "Jet-Cat" delivering 100 Newton are used in a "Ventus" sailplane, it is on top of a pylon, and use only 350 cc, of fuel per minute.

Martin Kappeler from Hamburg, is the operator of the Ventus CTT. The need for 10 Jets for the sailplane take off is another issue, both price and power, will fit our sailplanes.

Thanks for an interesting Newsletter and many happy landings to you and your team involved with the production of the journal. Regards, Nils-Ake Sandberg. Sweden.

*Editor's note. Nils..! It is very nice to know what is happening in Sweden. I cordially invite you to contribute with articles and be part of the team (those magnificent men) who make that this Newsletter pleasant reading.*

*It is your Newsletter and you make it good as it is.*

*And as the Erudite said..! The Australian Homebuilt Sailplane (A.H.S) is the result of a small group so people interested in building, flying, designing or who just like discussing home built sailplanes, can have easy access to other enthusiasts with the same aspirations. We try to offer building advice on where to obtain materials for a particular project.*

*Few people can appreciate what it is like to soar in a creation of your own handiwork and our objective is to assist as many builders as possible in achieving this goal*

*The Newsletter is our only way of communication and keeps everybody up to date with other builder's progress or their problems and answers to those problems, building, hint and tips and general interest articles.*

*We are a non profit group and the fee is only just to cover the cost of production and postage while the publishing work involved is honorary*

Dear James,

I attended the CASA Safety Seminar at the Melbourne Convention Centre on the weekend of 21-22 June 2003. This was at the time of the shortest day of the year and lots of rain and cold conditions were predicted so it seemed a good time to be inside. The weather bureau was optimistic. The rain did not come and it wasn't all that cold. I had the good fortune to talk to Keith Nolan who owns the Olympia "Yellow Witch" and also Bill Johnson. Bill had some new suggestions about how to modify my glider trailer for even easier loading and unloading! Keith said he enjoyed reading the newsletter and even liked my article about cheap tools. He then said, in a low voice, that he also was a cheap tool junkie and had even bought a few things from Crazy Clints!

With this encouragement I thought there might also be a few readers who would be interested in the cheap lock wire twister that I discovered the next day and which can be made at home for almost no cost at all! I enclose a short article. Peter Champness

Dear James,

I would like to join the association. Can you send me the forms etc? I am interested in a Powered sailplane similar to the Strojnik S2. I have to have a self launcher as I am on my own in a remote area. I urgently need a set of plans, hope you can help.
Your Sincerely,

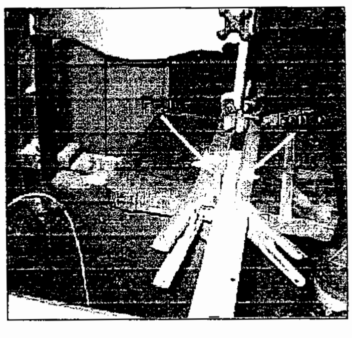
Roy Glen.
400 Blackjack Road
RD 2
Whitianga, 2856
New Zealand

## TECHNICALITIES

# RIPPING TIMBER

*By Peter Raphael. (The Erudite)*

Jim has asked me to drop a line regarding the most efficient means of cutting of thin timber strips. It is apparent that while the bench saw and fence will do an excellent job of this, the kerf width of a circular saw blade will account for a good deal of material wastage. My preference is to use the band saw, but there are a few important considerations in order to achieve success.
Firstly, while that well used blade band is fine for roughing out bits and pieces the set of the teeth will most likely be worn and unable to provide sufficient clearance and cutting action to allow the blade to track true. Even worse, if it is worn more on one side than the other it will tend to steer across the work and vary its track according to the pressure applied. Obtain a new blade of a sufficiently coarse nature, less teeth per inch in thicker materials and suitable for ripping work.



Ensure that the blade tension and blade guides are all correctly adjusted as this will minimize any twisting action.
Now to the setup of the fences; It is critical that the fence or

model of the Monarch as a chuck glider. The model has a span of 90cm and was made from the 3 views supplied with the plans which were enlarged on a photocopy machine to the required size. The model was constructed from discarded white styrene foam packaging material and a small amount of 1.5mm balsa sheet.

The fuselage was constructed of 1.5mm balsa with 10mm foam sheets glued onto each side, then sanded to shape. The wing was made of 7mm foam sheet with a full depth 1.5mm balsa spar and a balsa leading and trailing edge. The whole model was covered with tracing paper which is put on wet and glued with Aquadhere type glue which is thinned slightly with water and painted all over the surface of the foam. When it dries this produces a nice tight covering and greatly increases the rigidity of the structure. The model was then painted with a spray paint can.

The wing section was made to my own design and is quite thin because I think thin aerofoil sections work best on small models. The wing section has a maximum thickness quite close to the leading edge and then the upper surface is flat back to the trailing edge. The reflex is on the bottom surface over the rear 25% of the chord. This wing section approximates the NACA 43015 section but is only about 7% thick. It was quite easy to make using a sanding stick on the foam.

On the initial flight trials the model rotated backwards about the pitch axis. This was a good result as it suggested that I had in fact made a wing section with a positive pitching moment. The C of G at that time was at about 45% chord. It was then necessary to add nose weight progressively to get the C of G further forward. At about 25% I began to get a type of glide, and with the addition of two more small washers I have had some promising glides. It was a great thrill to see the Monarch skimming across the grass of the backyard. Trimming flights are continuing at present.

The next stage is a radio controlled model of about 2 metres span which I hope will be completed by the time of the next newsletter.

## An update on the state of play with my Woodstock project.

*By Malcolm Bennett.*

Both wings now have been assembled and the ply skins fitted. At 14 metres span I am still trying to decide on whether or not I will fit winglets, however, I will be incorporating mounting points in the tips in preparation should I choose to do so. The wings have also now been fitted to the fuselage and this has meant that the aileron circuits were able to be completed and are now operational. Not yet installed but pre-fitted is the turtle deck skin. This will be finally installed once all underlying work is completed.

Pylon mounting points have also been incorporated in the area of the centre section in preparation for an engine pylon mount.
The dive brakes have been assembled and installed in the wing but these will not be cut away from the wing skins until the load testing is complete, more on that later. The brakes are torque rod operated and the mechanisms are virtually complete, the only area remaining to finalize these being in the turtle deck area.

The instrument panel is now complete and installed, only requiring painting at a later date. A winch release has now been fabricated and is currently being plated prior to its installation. The seat pan and seat back are also now completed and now provide an opportunity to build the canopy. The canopy will use a Chrome Moly frame but I will need to experiment here to achieve the optimal solution. With a requirement for easy access/ egress and to be jettison able a side hinging is my preferred option but this will ultimately be determined by the ease with which I am able lift these wearying bones out of the cockpit.

My next major task is to undertake a proof loading regime on the wings. While I am awaiting a loading specification from GFA I am building a frame of 40 mm square steel tube from which I will suspend the wings for this test. My attention is now focused on the planning as the results of this test will determine how I progress beyond this point.

## Proof Loading of Woodstock Wings

*By Malcolm Bennett*

Having extended my wing to 14 metres and increased the payload requirement GFA have decided that they want the wings to be proof loaded.

The spar caps and shear webs have been increased to carry the span and payload increases.
A tube structure has been fabricated to mount the joinerd wings in the inverted position such that the chord is set at 10 degrees nose down. Both wings are fitted and loaded to remove the problem of eccentric loading of the mounting frame during the test.
Weights consisting of soil filled bags will be distributed along the wings to simulate the lift distribution at ½, 1 ½, 2 ½, 3 ½, 4 ½ and 5 G loadings. Measurement of deflection at a number of points along the spar will be made at each load and plotted on a graph to prove that the deformation is within the elastic limits of the structures resulting the result being that when unloaded the structure returns to its original condition..
This will mean that no damage has taken place and the structure is safe to load within the design parameters with 5 G limit load capability.

### Woodstock Airbrakes

*By Malcolm Bennet*

Cable operation of airbrakes relying on spring closing of the brake panel can be improved by changing the activation to torque tube within the wing.

Three bearing blocks made of sheet nylon type material are installed. One at the root rib, one at the rib beside the airbarke lever arm and the third halfway between these. A lever arm with an adjustable drag link is connected to the brake panel horn. There is an adjustable stop bracket under this arm on the torque fences are set parallel to the blade as otherwise it will immediately try to track across the work, jamming it against the fence or drawing the work away from the fence. Inserting a sample or gauge piece of material between the blade and the fence will generally reveal if any error is present, and a test cut with waste stock will verify this. It is wise not to assume that the blade will be square to the line of the table. A double fence is useful if you have to perform the ripping operation single handedly, along with due consideration as to where the materials will end up as they pass through the saw.

Finally, a steady feed rate is essential in order to allow the blade to do its work. Too fast and the variation in ring density, particularly in materials such as Oregon, can force the blade off course momentarily. Allowing the set on the blade to clear the cut with a constant feed rate will return the best result. Feed rate will generally be determined by material thickness and density, blade speed and tooth design.
What can be achieved with the humble bandsaw is really only limited to your ability and patience in feeding the work through the saw. I personally find it very satisfying when I am able to reclaim useable sections from recycled timber.

# WHAT'S NEW

## AN OPEN LETTER FROM JAPAN, FROM OUR FOUNDER

*Mark Stanley*

G'Day Jim,

Hello again to you down there. Long time no hear. I received an email from Peter Raphael (The Erudite) the other day saying that you had requested me to drop you a line with my email address.

That bit is easy. The direct email address in Japan is as follows ***tomiya@di.mbn.or.jp*** or you can still reach me at my old one ***vh-mws@riverland.net.au***. Either one is OK to use, they both end up here.

Peter tells me that in October 2004, it will be ten years since we started the association. It is almost unbelievable that 10 years has almost passed since then. It doesn't seem that long, almost unbelievable!

I said to him that I don't really feel a part of it as I have been out of it for so long.

I am very happy to see that the association is still going strong, this has so much to do with all of the efforts that yourself, Pete and all of the the other volunteers have put into keeping the group going, keeping the interest alive in homebuilding and keeping up with the newsletter, a task that I am sure some people still don't appreciate the amount of work required to get the next issue out

Pete (The Erudite) said that he passed the information regarding the prototype Windrose that I came across up here in Japan.. If anyone would like more info, they can contact me via email, snail mail or fax.

My address here is 3-5-23-505, Takahama, Mihama-Ku, CHIBA 2610003, JAPAN. Ph/Fax +81 43 279 6373.

Homebuilding up here is really a non event, the regulations are very strict and although it is not impossible to get something flying, it is much more difficult than down there. Even a simple task such as servicing a TOST release, it get sent to Germany to TOST to have it done, no one here can sign them out. The freedom there is in Australia really needs to be appreciated and it is only when you don't have to that I think you realize just how much of a Lucky Country it really is.

Perhaps many years ago, homebuilding was the way it all happened but I am not sure at present, it would need to be checked out. I know there are quite few old gliders sitting around doing nothing as 'new' is good, old is not so good. Some people appreciate the older aircraft but generally speaking, the young people don't really like the older aircraft.

The weather conditions up here are not very good for having aircraft just sitting for long periods as winter is very cold with snow in many places and summer generally has high humidity.

Many gliders sit either outside all year or live in trailers, mostly outside.

There are many examples of gliders in excellent condition but these usually have a hanger to live in or a large container truck that has been modified to suit the task.(Club hanger).

Most airfields are situated on river banks so when it floods , everything must be moved so that is the main reason smaller clubs don't build hangers on the airfield.

Some larger clubs do have hangers over the opposite side of the large levy banks that surround the rivers.

The aircraft are moved in one way or another over the bank each day they want to fly, it's a bit of a hassle but they seem happy with it. I guess they don't need to rig the gliders each time so that would be a bonus.

Anyway, this is a bit short but time is a bit of a problem up here. As time permits, I will try to put something together and let you know what is happening.

## Marske Monarch Update Sep 2003

*Peter Champness*

Since the last communication I have had a letter from Evan Pryce in Adelaide. Evan has been nursing the idea of building a glider and thinks the Monarch might be a good project. I have sent him the plans to look over. If there is anyone else out there who is interested we might have the basis of a builders group.

I have not yet written to Mat Redsell (Marske Sailplanes) to ask about the Spar construction and the wing rib web material. I was uncertain about both of these and others have said they did not understand the plans either.

In the meantime I have amused myself by building a small scale

tube to allow setting of the over centre locking. Two cables with a turn-around pulley fitted to the brake lever in the cockpit are routed back to two turn around pulleys set up in the fuselage below the torque tube and up around a quadrant.mounted on a telescopic cross tube to connect to both wing torque tubes. This crossover tube is carried in nylon bearings bracketed to the ply deck of the fuselage.
The ends of the torque tubes in the wings and the telescopic tube have fittings with two holes driven by a fitting with two dowel pins.
As the wings are removed by lifting to disengage the hanger brackets a telescopic tube is required. You pull the pin joining the two halves, telescope the tube disengaging the drive pins at each end and then you can lift the wings away.
This system removes loose pins, safety pins and spring retained brakes. The brakes when closed are locked shut by the over centre of the lever arm on the torque tube adjacent to each brake.

## HINTS & TIPS

### CUTTING PLYWOOD WITHOUT A PROBLEM.

*By Andre Maertens*

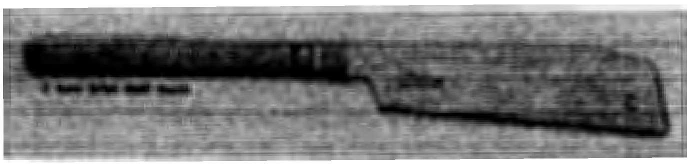
In order to cut plywood without problems, I use short pieces of hacksaw blades (min 18 teeth per inch) I grind the end to suit my jigsaw and start slowly accelerating as the blade goes into the sheet of ply.

I have cut through 2" of hard wood with this set up. Try it and you will be pleased.

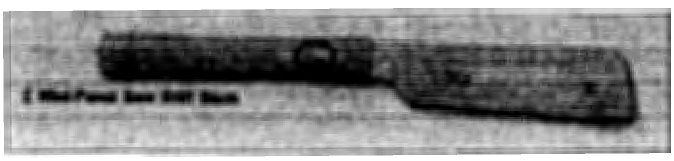
However due to the blade width it is almost impossible to cut in circles unless they are of larger diameter.

Also a good tradesman quality **(Z)** Japanese saw will do the trick. There are two choices:

**Choice 1**
Fine tooth joinery saw. Blade length 240 mm, blade thickness 0.30mm, t.p.i. 25. Very fine cut saw producing extremely precise cuts. Weight 210 g.



**Choice 2**
General purpose saw ( plunge cut ). Blade length 150 mm, kerf 0.51 mm, blade thickness 0.30 mm. t.p.i. 18. Fine purpose saw suitable for all class of jobs. This saw has a scribing tooth near the front edge, this gives the added capability of plunge cutting. Weight: 120 g.



Price around A$ 40.00 and A$80.00
All of them available from CARBA –TEC.
www.carbatec.com.au. Branches in Brisbane, Sydney, Canberra, Melbourne and Perth.

## LINSAY OLEN'S RAMBLINGS

I love your newsletter. Although I have no formal education in fluid dynamics I have designed many model planes and boats. Some I have built and tested. My designs often outperform those of qualified designers so others take the credit.

Flying wings make better gliders. The secret is to put the whole structure to work in assisting flight rather than appending a streamlined container to a small set of wings.

The Horten brothers understood this. You can learn much from studying birds, Leonardo da Vinci understood birds much better than others understood Leonardo.

The simple flying wing design that was built and flown by Scott Winton as the "Facet Opal" was drawn up by me during an air show in Casino. This was in response to a request from Paul Garret for the simplest possible flying wing that could be built as an ultra-light. Paul had a friend who built ultra-lights and he was looking for a new design.

The simplest airfoil for flying wing is symmetrical arcs with a 20 degree TE and some reflex. This is as good as the best traditional foils.

The Opal was a flying plank of about 12 ½ % thickness to chord, a6 foot chord by 18 foot span with 2 foot symmetrical tips heavily swept back from the front. A fixed tricycle under cart gave plenty of ground clearance to the propeller, which was protected by a steel ski.

Unfortunately Scott fitted a retractable under cart to get higher speed and it was shorter than the legs I had specified. Elevons and upwardly operating split flap. A glider type cockpit. 150 knots, 200 NM range and 30.000 feet on only a 40 HP "Rotax". Direct drive to a low aspect ratio thin propeller.

The same design would make a fine self-launching high speed sailplane with about 10 HP and a free wheeling clutch. Single wheel built in behind C of G.

The inner 8 metres plant form of the 1939 Horten 4 would also make an excellent high speed sailplane. Extend the prone pilot position forwards to balance the lighter machine. Shoulder harness. Dual three axis armrest controls. Symmetrical aerofoil with constant curvature. No washout. Ten degrees dihedral. Single wheel just aft of C of G and nose skid. Small twin fins one metre from centerline, toed slightly. Flat outer surfaces with independent drag rudders, cambered inner surface. Skid wing fences under fins.

*Eds note. At the end in the Classified section, you will find a very good book "BIRD FLIGHT AS THEIR BASIS OF AVIATION" By Otto Lilienthal. Available from the address shown.*

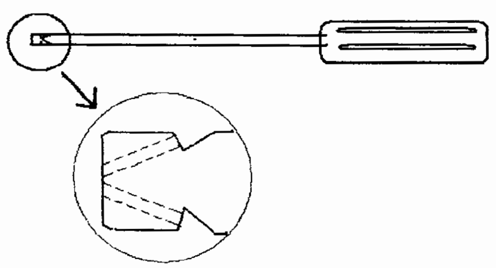
# LOCK WIRE TWISTER

*By Peter Champness.*

On Sunday 22 June 2003 Stephen Bell, a LAME with CASA conducted a short course on 'Aircraft Maintenance which can be performed by Pilots' at Moorabin Airport. We were shown how to change spark plugs, change a wheel and apply lock wire to stops nuts coming undone.

Stephen had a nice pair of lock wire pliers which is a very nice device and fun to use. I had more or less decided to buy myself a pair when he showed us as a further example his lock wire screw driver.

This tool looks rather like a screw driver but has no blade on the end. Instead it has two holes in the end to take the ends of the lock wire and a groove near the end where the lock wire comes out. The ends of the lock wire are fed through the holes and the driver is then rotated twisting up the lock wire. The wire feeds in through the holes automatically as the twist progresses.



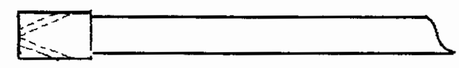
**Steve Bell Lockwire Screwdriver**

Some of the people present thought that it might be possible to make a lock wire screw driver at home using an old screw driver if one had a lathe and a drill press. It seemed like such a simple device that I thought I might try it even though I don't have a lathe ***(maybe my friend the Editor Jim Garay can help me, he has a lathe),*** I certainly have a few old ruined screw drivers and it wasn't hard to cut the end off one of them using a hacksaw. The next step was to drill the holes and here I had a lot of grief.

The screw driver was a cheap one but none the less the steel was very hard! I blunted a centre punch trying to mark the drill hole positions in the end. The 1/16 drill skidded all over the surface and didn't even make an impression on the metal.

At this stage I thought of using something softer to make the tool and tried a tent peg with only slightly better result. Casting about the shed for something else I found a piece of ¼ inch wooden dowel. The dowel was easy to drill even with a hand drill. At the first attempt I produced quite a nice twist in a piece of lock wire.

At the second attempt I pushed the dowel up too close to the base of the wire and the wood split turning one of the holes into a groove and the tool was ruined. This was not entirely unexpected. The end of the dowel needed to be re-enforced.



**Home made Lockwire Twister**

I had in my model tool box some brass tubing. Small diameter brass tubing is readily available in all model shops and most hardware stores if you don't already have some. You need brass tubing which is a tight fit on the end of your dowel. If it is a bit loose try painting the end of the dowel first to increase the thickness. The end of the dowel was hammered into the end of the tubing and then cut off. Only about ¼ inch of brass re-enforcement is required. The two angled holes where then drilled in the end. A handle is not required. Lock wire is soft and the dowel is easily twisted between finger and thumb. I have made quite a few wire twists with the dowel and they are quite easy to do and look good with nice even, closely spaced twisted wire strands.

***Eds note. Yes Peter any time!***

## SHOP TALK

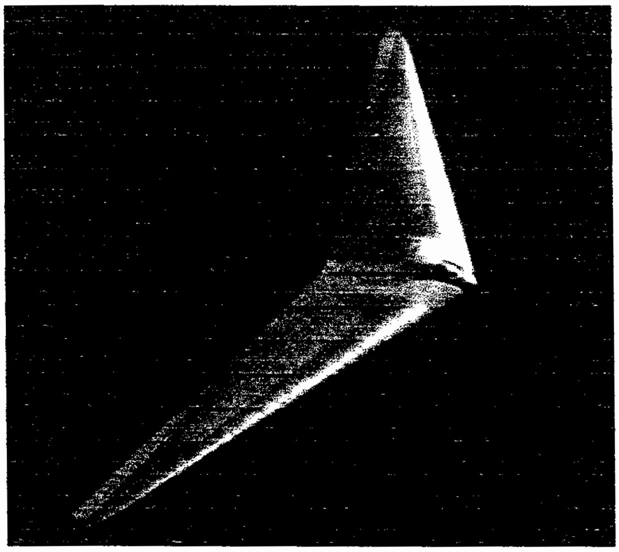
# THE HORTENS BROTHERS

*By Martin Simons.*

*(Eds Note. This is an excerpt from Martin Simons excellent book SAILPLANES. 1920-1945. With thanks)..*

Walter and Reimar Horten became interested in tailless aircraft after seeing Lippisch's Storch and Delta, and like Lippisch they tested many models before beginning a full scale sailplane, the Horten I, which they took to the 1934 Rhon competition. Although it flew for a total of about seven hours it recorded only one official contest flight. They abandoned and burned it on the Wasserkuppe, returning home to build the Horten II, which flew as a sailplane in 1935 and was much more satisfactory. It was fitted experimentally with a motor. Three more H II sailplanes were built and two of them flew in the 1937 competitions.

Able to find some official backing for their work, the brothers produced the Horten III in 1938. This was a very large sailplane which flew most impressively. Rudder control was provided by wing tip brakes. The cockpit was in the middle of the wing, with a streamlined transparent canopy, but there were also large transparent panels in the leading edge to give a view of the ground. The undercarriage was partially retractable. Several different versions were built. Two of these competed in the 1938 Rhon, one, designated Horten III C, had a small auxiliary wing mounted just ahead of the cockpit.



Unfortunately, Blech, the pilot of one of these aircraft, was killed on impact in a mid air collision in cloud. His automatic parachute brought his body to earth. The Horten III D had a motor with a folding propeller.

Four pilots flew the Horten IIIs in the 1939 competition but did not do remarkably well. As contest sailplanes these aircraft were considered too lightly loaded and slow. Higher wing loading and higher aspect ratios were required for cross country flying. The type was also used extensively in further experiments with motors, one was tried with a prone pilot, and there was a two seat version. Sixteen were flown altogether.

The Horten IV of 1941 incorporated all the lessons learned from the earlier types. The wing had a high aspect ratio, the pilot was in a semi prone or half kneeling position faired with a smoothly contoured canopy. The controls were operated by a yoke and there was a added chin rest, essential if the pilot was to look directly ahead for long periods. The undercarriage was retractable to reduce all sources of parasitic drag. The wing tips, very thin and narrow, were fabricated in light alloy. Flight test showed that the sailplane was fully controllable although no one described it as easy to manage in the air. Centre of gravity placement, as usual with tailless aircraft, had to be very precise. The performance was not as good as expected.
A Horten IV, with "laminar" flow wing profile copied from the American P-51 fighter, was flown but proved dangerously liable to flutter, and crashed killing its pilot.

The Horten VI, two of which were built in the closing months of World War 2, had a wing span of 24.25 metres in an attempt to improve the performance. A best glide ratio of 43:1 was anticipated.

Flight tests were started but had to be curtailed as the American armies captured Gottingen where the tests were going on. One of the Horten VI was taken to the USA for study by Northrop Company, but did not fly again.

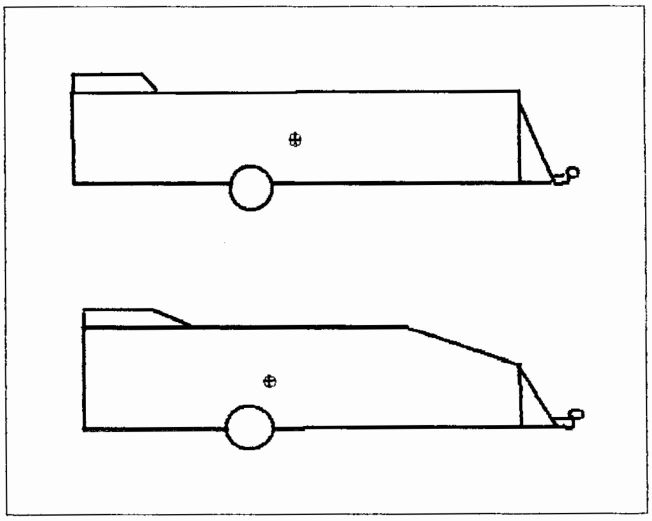
One Horten IV survived in Germany to be flown by the British Air Force until damaged seriously in a landing accident at Scharfoldendorf. The wing tips had been at some time replaced with wooden tips. A Horten IV was extensively flown in the USA in post war times and was the subject of a study at the Mississipi State University in 1959, and reported to the OSTIV Congress in 1960. The results were not as good as expected. In recent years, one of the surviving Horten IVs, probably the one used by the British in 1946-8, has been completely restored at the Oberschleissheim division of the Deutches Museum in Munich.

The Horten brothers continued to design tailles aircraft after the war, producing both sailplanes and powered aircraft.

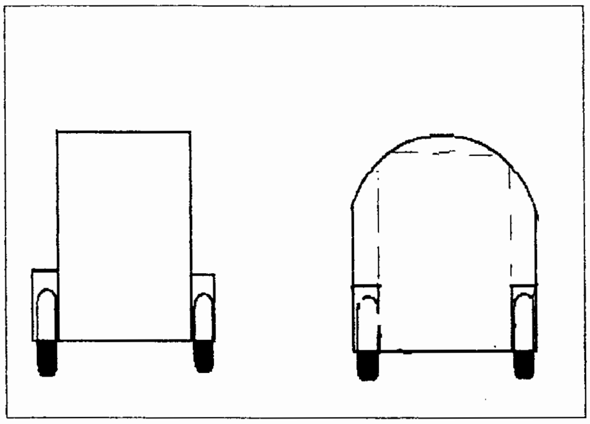
## TRAILER TALK TWO

*By Peter Champness*

In the last article I proposed some alterations which I thought might improve the handling of my glider trailer especially when subjected to strong side winds. I had meant to include some diagrams with the article but had not prepared them in time for publication. However they are ready now.



Cutting away the upper part of the front of the trailer not only improves the aerodynamics of the trailer to normal forward speed but also moves the centre of lateral area backwards closer to the axle. This is expected to improve the trailers response to side gusts. Extending the fin box has a similar effect.



Curving the top of the trailer reduces the resistance to side gusts. Extending the sides outwards gives room for a curve of greater radius but the overall width of the trailed is not increased if the wheels are included within the side skirt

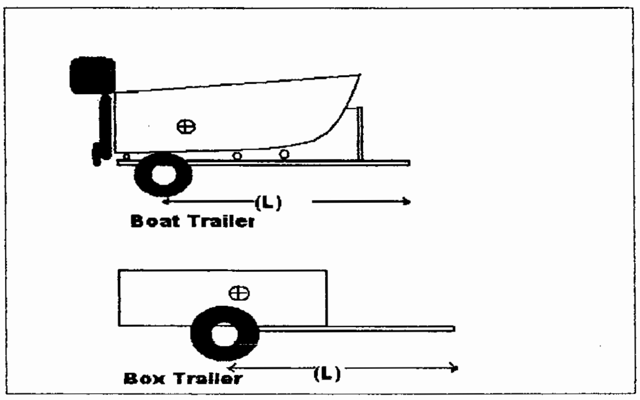
The next region of improvement is to consider the axle placement and distribution of mass in the trailer. The glider trailer is a poor design from the start for towing stability

the axle, which is an essential condition for towing stability, but they do not give any further advice on improving towing behaviour.

I discussed this issue with David Wilson of the VFMG. He wrote down a formula which he said would guarantee good towing behaviour. I don't remember the formula exactly but in essence it suggested that the trailer would be stable if the towing length (L) was long compared with the sum if the individual moments of masses in the trailer with respect to the axle.

I went to have a look a yard full of boat trailers because they generally tow very well. Two things were interesting. The first was that almost all power boats have a very heavy weight (the engine) behind the axle. This should cause instability but it doesn't have a large effect because it is not very far behind the axle. Of much greater importance is the fact that the Axle is very far back.

Another class of trailer that has good towing behaviour is the semi trailer. Again the axle(s) are very far back. Domestic box trailers by comparison have the axle in the middle but the load area is small and hence the load is close to the axle. The draw bar by comparison is relatively long. The towing length (L) represents a lever which controls the wayward mass of the trailer. A long lever easily controls a short trailer. A long trailer needs an even longer lever.




The implication is that to improve towing behaviour we should increase the towing length (L) either by increasing the length of the draw bar or moving the axle further back. Increasing the length of the draw bar would be a relatively simple fix but it is a disadvantage to increase the overall length of the trailer any further because it just fits into my rear driveway as it is. Therefore we should look at the possibility of moving the axle further back.

Moving the axle back is not difficult but it does cause a problem. The C of G is now a long way forward of the axle and the tow ball weight is very heavy. Now it is very difficult to lift the front of the trailer up to get the jockey wheel on. The jockey wheel sinks in soft ground and muddy soil, and if the tow ball weight is too heavy it will exceed the maximum allowed for the car.

The problem first is to move mass back in the trailer. If the C of G is moved back the axle can then be moved back keeping the tow ball weight unchanged.

The glider itself cannot be changed. It can however be placed in the trailer in a way that gets the weight back as far as possible. A lot of modern gliders are placed with the wing roots at the front and the glider facing forward. This arrangement is good for loading and unloading the trailer but it puts the weight of the glider as far forward as possible and hence the axle has to be forward which is bad for towing. Most wooden gliders are loaded with the wing roots at the back and the fuselage facing forward. This is a good compromise. The forward weight of the fuselage is balanced by the heavier weight of the wing roots at the rear and the overall weight of the glider is close to the empty C of G of the trailer so the tow ball weight is reasonable in both the empty and the loaded states.

It is possible to load the wing roots at the back and the fuselage facing the rear. This gets the weight of the glider as far back as possible. My Super Arrow trailer is arranged like this and it tows very well. Because the fuselage faces to the rear the fin box is at the front and hence the glider must be loaded in from the front of the trailer. The draw bar is designed to swing away from the front of the trailer and the trailer must be unhitched from the car to load and unload the trailer. Most people would think that was too much trouble unless they had real trouble with towing.

Regardless of the way the glider is loaded into the trailer it is still possible to get the weight in the trailer further back. A look in my trailer revealed several heavy items which are stored at the front. The spare wheel is at the front and so is the jack, wheel brace and tool box and trailer tie down kit. The spare wheel weighs 15 kilograms and the other items weigh a total of twenty kilograms. Then there is the tow out gear which may also be stored at the front. A check of the trailer park revealed that most glider trailers are the same. All this gear should be stored at the back. Then the axle can be moved back also.

The spare wheel and the tool box will get in the way of loading and unloading the glider if they are stored inside the trailer And hence they must be bolted on the outside of the trailer, preferably close behind the axle. The tow out gear has to come out with the glider anyway so it can go at the back. The main problem is finding enough space at the back of the trailer for all the bits. The folding wing wheel helps a bit here (see article on folding wing wheel in this issue).

Hopefully by the time the next issue is published I will have done some of these things to my trailer and I will be able to tell you if any of them work!

## PROOF LOADING THE BENNET'S WOODSTOCK

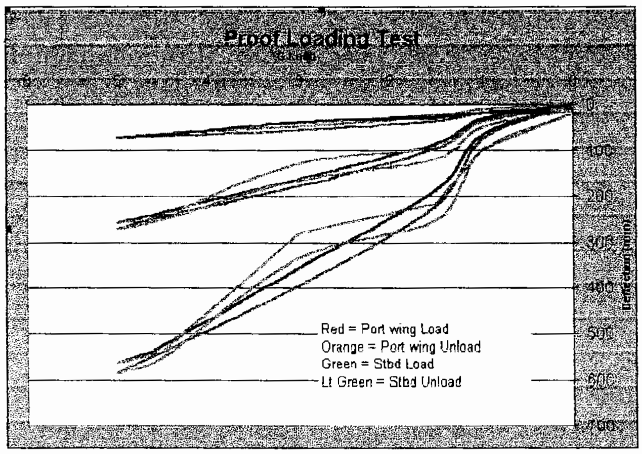
*By Peter Raphael. The Erudite.*

On the Saturday of  August a select group of individuals gathered in the workshop of Malcolm Bennett to participate, document and witness the proof loading of a pair of glider wings.

Mal has been working feverishly on his much-modified Woodstock since the completion of James Garays glider. Mal has altered the original mission profile that Jim Maupin had designed to and has incorporated a number of major modifications to meet his objectives. Regular readers will be familiar with some of these by way of previous articles contributed by Mal explaining what he is doing. For those of you who are still catching up a brief summary is in order. Mal has extended the span to 14 metres and with the intention of incorporating a self-launching capability, additional payload and possibly winglets, a beefing up of the spar was necessary. While to some extent the numbers were available to quantify these changes, certain unknown factors meant that it would be prudent, if not definitive, to conduct a static loading of the wing to 5G to satisfy all that the requirements would be met.

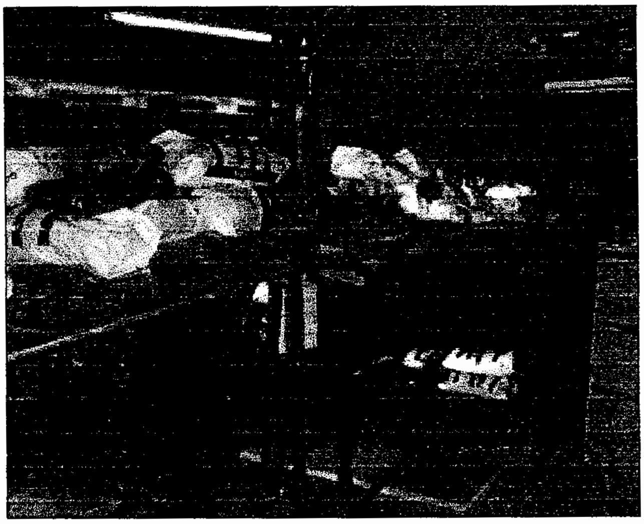
Not an exercise for the feint of heart, this task meant that approximately a tonne of weight would need to be distributed across the inverted and suspended wing in stages, any anomalies observed and measurements taken to confirm that the wing remained within its elastic limits.

Much preliminary work had to be undertaken in preparation for the test, as a stand was required to support the wings. Mal had constructed this out of some 25mm reclaimed steel tubing, a sort of mini Eiffel Tower with a large base designed to spread the load across the workshop floor. In the final stages the wings had to be assembled in an inverted position at a ten degree positive incidence and mainpins installed thus enabling the wing hangers to be aligned with the supporting structure. An additional brace was also added to support the wing at the dragspar.




A no less arduous task was the bagging of soil to create the weights required to load the wing. John Ashford of the GFA had provided a loading schedule by which Mal was able to create a limited variety of weights to meet the required steps of 1, 1.5, 3, 4.5 and 5 G. These polythene parcels were all wrapped, taped, marked and stacked under the wing awaiting their turn in the process. Anybody looking for some additional landfill should talk to Mal first!

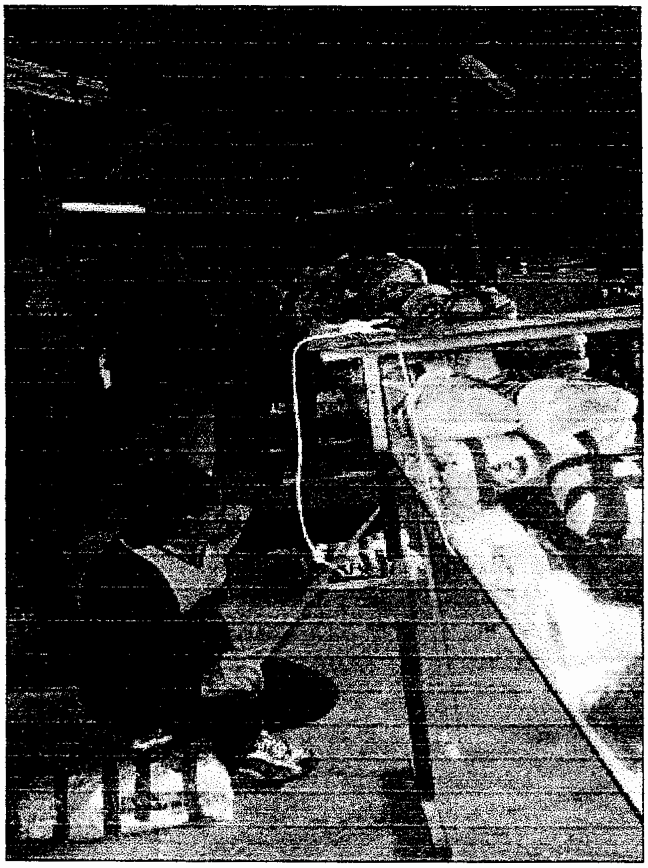
When the big arrived a group of  about 11 assembled to assist with the task. The key players in the operation were John Ashford as the loadmaster, he would instruct the team where and when to place the weights. As well, Alan Patching, a man with a lifetime of experience in the analysis and testing of aircraft structures, would be briefing and guiding the team through the fundamentals of the exercise. Above all John stipulated that excessive noise was to be discouraged as we would need to listen to the wings "talking" to us and that the breaking of sticks in the background would not be tolerated.<grin>



After the establishment of reference points along the wings and initial measurements taken it was time for the fun to begin. An event not to be missed whatever the outcome it was with video cameras running and other still cameras at the ready that the slow and steady sequence of loading commenced.

Working in teams of two, loads were placed symmetrically and progressively along both wings until the required mass was in place. Once all had stabilised measurements were taken at the datum points and recorded on the load sheet. Visual inspections ensured that the structure was showing no localised trauma and depression measurements were taken of the upper wingskins. When this had been done the exercise was repeated to the next schedule. Have an excess of helpers around at this stage can advantageous as there is much observation and recording of the event to be done.

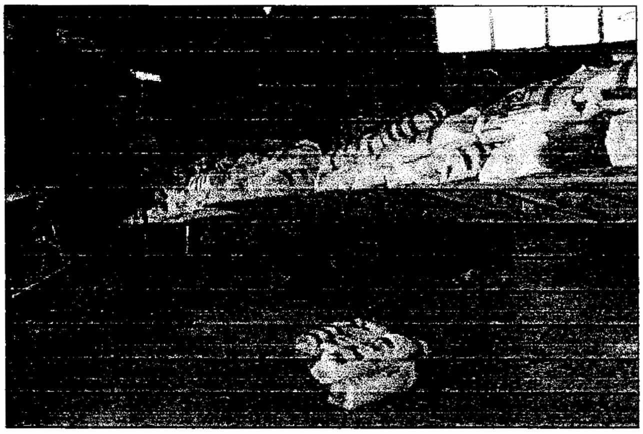
Certainly, the final stages are the most exciting and when the wings were approaching their final deflection of almost 600 mm



*The Erudite in action.*

at the tips one could not help but be impressed by the fact that bonded wooden wings can tolerate this treatment and bounce back for more. A couple of minor, but heart stopping, creaks along the way were the only complains made by the wings through all this torture. These were put down to movement in the main fittings as they took up under load.

After a period of observation and inspection it was time to reverse the procedure and progressively return to our starting point in order establish that there was no permanent deformation of the structure. Having done this the results were quickly graphed on an Excel spreadsheet and as a result, pronounced satisfactory.



Anticlimactically, everyone conveyed their congratulations to Mal and drifted away to the rest of their weekend. Surmounting a major hurdle, Mal is now able to progress onto more productive aspects of the project and is now completing the airbrakes in anticipation of covering the wings.
Not a common event these days, the proof loading of a pair of wings is an experience not to be passed up. So if you get the opportunity, get involved and become one of the enlightened.

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Hello Everyone,
I have now arranged with the support of the Victorian Association to have Gerhard Waibel speak as follows:

Date: Wednesday 5th November
Time 6.30pm for pre talk drinks and food
Place: The Airforce Club, 4 Cromwell Road, South Yarra
Note-There is car parking on site through the gateway.
Cost: $5 per person on arrival
Please contact Alan Patching Ph 9817 5362 or email
calbpatc@netspace.net.au
so that catering arrangements can be finalised.

**Title of Lecture: The Sailplanes of 2050**

Gerhard gave this talk last year as the <Barnaby Lecture> to members of the OSTIV Sailplane Development Panel and the Sailplane Homebuilders Association in Tehachapi, USA, which John Ashford and I attended.

In his talk Gerhard will trace the development and improvement of gliders since the Lilienthal hang glider to the latest sailplane - ETA. This machine has a lift to drag ratio of over 70 to 1!!! Current sailplanes are flying distances of 3000 km and achieving cross country speeds in excess of 200km/h. Apart from the impact of World War 2 there has been a steady increase in performance and Gerhard will describe how he expects this trend to continue until 2050.

Some notes on Gerhard Waibel.
He graduated from the Darmstadt University where in1964 along with Lemke, Holighaus and Friess they produced the high performance D36 glider. Waibel, Lemke and Holighaus all became successful glider designers while Friess was in charge of

glider certification at the Ministry. In 1985 the team was awarded the OSTIV Prize for their contribution to the design, construction, testing and certification of modern sailplanes.
Waibel was also a top competition pilot and won the German Championships in 1964 in the D36.
As chief designer for Schleicher Sailplanes until September 2003. he was responsible for the ASW series commencing with the ASW12 which was used by many pilots to set world records in the USA. The ASW17 was flown by Hans-Werner Grosse to set new records here in Australia. The ASW22 was one of the first gliders to have a lift to drag ratio of 60 to 1. His latest design the ASW 28 contains outstanding aerodynamic and structural features.
Gerhard has been a leader in safety research and in designing safer gliders for pilots. In 1993 he was awarded the OSTIV Prize for his exceptional contributions to safety, especially in the design of crashworthy cockpits which have been proven to be effective with the survival of the pilot in a number of accidents.
He has been a key member of the OSTIV Sailplane Development Panel for many years contributing to the production of Airworthiness Design Standards for Sailplanes.

I would be pleased if you could advertise this notice.
Thanks Alan Patching.

## WOODSTOCK WING LOAD TEST

*By Peter Champness*

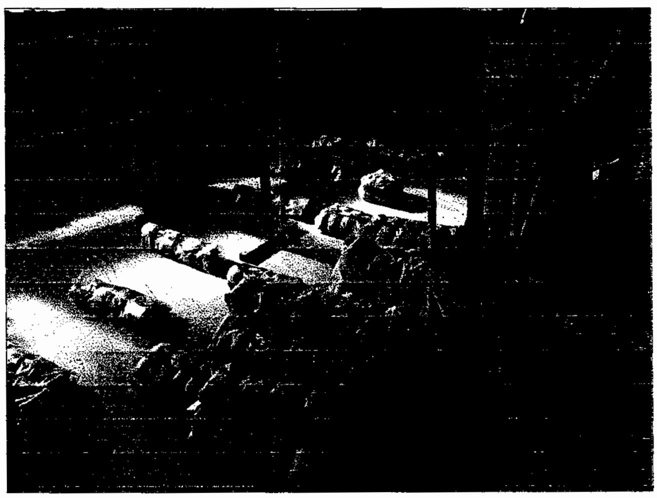
Malcolm Bennett's Super Woodstock is nearing completion. Malcolm has planned several modifications to his glider. One of these is the addition of one metre of span to each wing tip increasing the span to 14 metres. Another is the potential addition of an engine for self launching capability. The exact details of the engine installation are yet to be revealed but I understand that he is planning to use a Konig 3 cylinder radial engine and that it may be retractable into the turtle deck behind the cockpit when not in use.

Both the addition of extra span and the addition of the extra weight of the engine increase the bending loads on the wing beyond that envisaged by the designer, Jim Maupin. As a consequence it was necessary for Malcolm to modify the design to increase the strength of the wing. This was done by increasing the size of the spar caps. The original spar was a box section at the root with a web on both the front and back of the spar caps and a 'C' section at the tip with a ply web on the rear surface. The ply 'D ' nose section is glued to the spar caps. Malcolm modified the spar by adding additional span wise cap strips to the box section (to make a double 'I' beam) and at the back of the 'C' section to make an 'I' beam at the tip. The 'D' nose ply and the ply web and the rib construction were, as far as I know, not altered.

*The Woodstock wing ready for testing. With no load the wings are nice and straight! The piles of plastic bags under the wing contain a tonne of topsoil. The leading edge is marked with a strip of black tape to facilitate measurement of wing bending under load. The wing is tilted about 15 degrees down to simulate the near stall condition.*

Preliminary calculations suggested that the modification should be strong enough for the anticipated loads. However calculations are not always enough! Hence it was planned that the wing should be loaded to the design working load of 5G prior to the completion of the glider, both to confirm the calculations and to expose any unanticipated weakness at the increased wing loads.

The Wing Load Test was conducted on Saturday 31 August 2003 in Malcolm's workshop. It was a very cold day, the last day of Winter, with rain showers in Melbourne and snow falls on the Victorian Alps. None the less a good crowd of Homebuilder enthusiasts gathered at the Bennett property to assist as required. John Ashford had done the calculations for the required wing weights and Alan Patching was there to advise. Alan was fully dressed up in his engineers blue dustcoat which was rather impressive! The rest of us were there to lift weights and measure or generally help if required. The helpers were Peter Arnott, Peter Raphael, James Garay, Eddie Self, Peter Champness, Hans Prem, Wayne Mackley and Malcolm's brother in law Greg Evans.

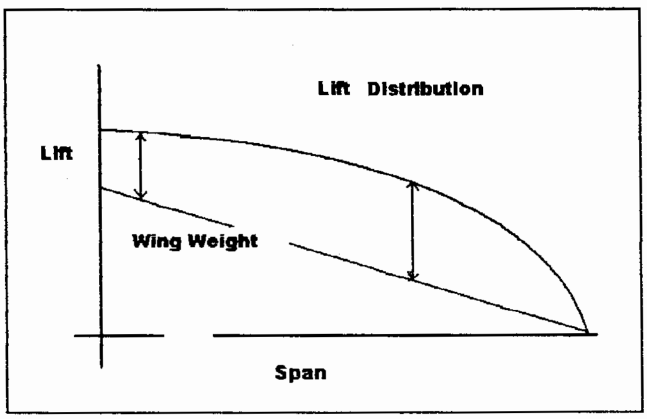


*Bags of topsoil ready for loading. The large bags weigh 14 kg.*

A great deal of work had been done prior to the day. When we arrived the wing had been assembled upside down on a steel 'A' frame, carefully constructed to the same dimension as the width of the fuselage. A large number of plastic bags were stacked under and around the wing labeled with the various weights which varied from 4 to 14kg. I thought the bags were filled with Mordialloc beach sand but it later emerged that they were filled with top soil. I expect that Malcolm had some gardening planned after the test was completed. Filling and weighing the bags would have taken the whole morning for the team but happily this had already been done. A total of one tonne was the calculated load on the wing at 5G and that was the weight of all the bags with a few extras for good measure. The wing had also been prepared with the loading stations labeled from the root to the tip in even numbers from 2-22. The leading edge had also been marked with black tape with from root to tip with three measuring points on each side to measure deflections at various loads. Finally a metal frame was placed under each wing about 1/3 in from the tip carrying a loose rope under the wing. This was to prevent a tip over if the weights were not loaded evenly and to catch the bits if the worse came to the worse and the wing failed.

Alan Patching organized us into teams on each wing. Two to load the weights, one to steady the wing tip as the weights were put on, one to measure the wing deflection at three points along the span at each loading and one to record the results. Thus everyone had a job. Indeed the minimum number of people to do this test would be four, two load weights and two to steady wing tips, then do the measurements.

There was a good deal of anticipation when John Ashford called for the first weights to be put on. An initial set of weights were designated as the pre-load. I don't fully understand what they represent but they were each of about 4 kilograms. This was no big deal and the wing hardly noticed. The next set however were 9 kg each at each station, representing a wing loading of 1G. At this loading the wing had a measurable bend from root to tip. 9kg is a lot to plonk at the wing tip 7 metres from the root and I was surprised that the load applied to the inner sections seemed small compared to the weight placed at the tip. The explanation is that the wing has also to carry its own weight as well as the weight of the fuselage. The weight of the wing is much greater near the root.

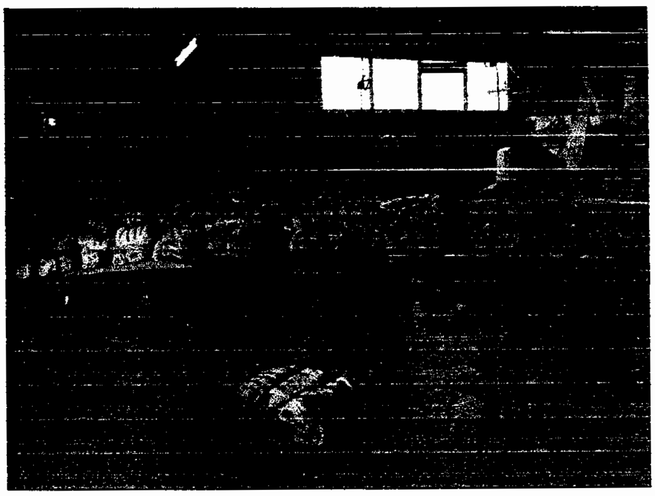



*The fuselage loads carried by the wing are greater near the tip than expected at lower G loads because the wing has to lift its own weight as well as the fuselage. The weight of the wing is greater at the root.*

The next set of weights were 14kg at each station. 14kg is about the weight of a full bag of fertilizer at the garden shop or a moderately large suitcase. Eleven of these were placed on Each Wing to make 2G. So far all was well but the ropes under the outboard wing supports had to be slackened off to allow for the wing bend. Loading progressed and at 3G some wrinkles appeared in the 'D' nose ply at about mid span. Malcolm took careful note but John Ashford and Alan Patching appeared unconcerned. The wrinkles got progressively worse at 4G and 5G but disappeared gradually after the wing was unloaded.

At 4G John Ashford asked for 14kg at the inboard stations and 9kg on the three outboard stations. The 9kg bags had all been used up. John thought we could make some more bags but Malcolm said "Where is the top soil going to come from?" Rather than dig up his back lawn he elected to put 10kg at each outboard station instead of 9 because there were a few 5kg bags left over. At this point we were all reminded not to snap little pieces of wood behind our backs! The load did look quite alarming and the wing had an impressive bend. The final load was to 5G. A "crack' was heard and it took some time to find the break. It was found that the trailing edge was in considerable tension causing the rib at the aileron cutout to bend. A compression failure occurred in the rib cap strip. This should be easily repaired with some strengthening.
After all the deflection measurements were taken the wing was gradually unloaded again and the bending deflections were again measured at each G loading. The wing had been loaded to 5G for more than 5 minutes which is a very unlikely situation in flight and quite reassuring because wooden structures will usually withstand greater brief 'shock' loads than continuous bending loads.

By this time I was feeling quite tired out because I had just lifted ½ tonne of weights on to the wing and then taken ½ tonne off again. Alan Patching was unsympathetic and admonished the loaders for dropping the weights on the floor!



*The wing at full load. The bags needed to be carefully placed to prevent them falling off, especially near the tip where there was quite a slope. Note the frame near the wing tip to catch the pieces if the wing failed. Malcolm is measuring wrinkles in the 'D' ply. Peter Raphael near the wing tip is measuring the wing deflection.*

The final step was to examine the wing bending deflection measurements. Ideally the wing will bend progressively under load and the return to its original shape when the load is removed. A sudden change in the amount of bending with an increase in load could indicate a failure which would also be revealed by a significant difference in the measurements during unloading compared to the loading up condition. Peter Raphael set to with the computer, firstly entering all the measurements into an Excel spreadsheet program and then using some computer magic to plot deflection against load at each measurement station. This took a bit of time to do. Alan Patching thought that the same job could have been done in half the time with good old fashioned pencil, ruler and graph paper, which is no doubt true. The result was very satisfactory. The deflection against load was almost a straight line and the unloading deflections were the same as the loading measurements.

By now Malcolm was looking a lot happier than he had been in the middle of the proceedings, when the ply was wrinkling and the rib cap cracked! He even allowed that he had at one point thought he might be cleaning up the whole wing into the bin with a broom. He was happy now to express his confidence in wood and epoxy glue!

## LAUNCHING GLIDERS

*Peter Champness*

The cost of launching our gliders has probably not changed a great deal in real terms over the years but that doesn't mean that it is not a significant cost. Just as we notice the cost of petrol and think it a very significant cost of motoring every time we fill up at the pump the cost of launching gliders hits us every time we get a flying day. The other costs seem to be minimal except for accidental damage (which can be fairly hurtful when it occurs) since they are not directly related to flying hours. In fact the more you fly your glider the cheaper it becomes per flying hour since the other operating costs are more or less fixed each year. These costs include annual inspections and maintenance, insurance, depreciation and the opportunity cost of money. The opportunity cost of money is an accountant's concept but is quite a real cost if you own your own glider. If you had invested the cost of the glider in an interest bearing account instead of purchasing the glider it could have earned about 7% each year, possibly a lot more if invested in the stock market over the past year. If the glider cost $40,000 (say the cost of a new PW5 these days) then the opportunity cost at 7%/year is $2,800 which pays for quite a lot of flying in club gliders if you don't mind doing that instead.

However, to get back to my subject, launching cost are quite high and they seem to be going UP! This set me to thinking about alternative launching techniques. Most of my ideas were impracticable such as foot launching, bungees, solid fuel rocket boosters, pulse jet engines and cable devices powered by falling weights. Ignoring for the moment self launching engines ( because they are difficult to retrofit to existing designs and probably increase the cost of launching overall), three methods remained: car towing, winch launching and aero towing.

Car towing seems to me to have been rather neglected in Australia. The Americans seem to have used this method successfully especially for the lighter gliders such as homebuilts but it does not seem to have been popular here. The probable reason is that dry lake beds in America are relatively smooth. By comparison a vehicle driven at 100kph over rough sheep paddocks in Australia has a very short life. None the less old un roadworthy cars are pretty cheap. The other requirements are a fairly large paddock, three crew members: one driver, one observer to look back and see what is happening to the glider, one launch assistant and 2000 ft of rope.

John Lynch told me of one rather interesting variation on this idea which he had seen used in England. If a turnaround pulley is used at the far end of the airfield the car then drives toward the glider and the car driver has the glider in view during the launch. It is usual to have about 4000-5000 feet of wire rather than rope for this type of launch because the wire is dragged over the ground which would cause rapid wear on rope with our usual surfaces. Because the wire is being pulled in toward the pulley, just as with a winch launch, heights of about 1/3 the length of the wire can be expected. After the glider releases the driver continues on toward the launch point thereby delivering the end of the wire back to the launch point. Another parachute is then attached to the end of the wire and another glider hooked on. The car drives back to the pulley end of the wire and unhooks the parachute and hooks on, ready to launch the next glider. The car driver should initially drive an arc of a circle around the pulley as he accelerates before straightening up toward the launch point. This gives a smooth rapid acceleration to the glider, similar to the technique used by powerboat drivers when dragging water-skiers. A lot of gliders can be launched in a short time with this method.

Winch launching is undoubtedly the cheapest practicable method of glider launching currently practiced. Regrettably not all gliding clubs can use it because they use small airfields or because of restrictions caused by other aircraft sharing the gliding airfield. The danger is also relatively great not only to the sailplane and pilot due to stalls and other accidents at the launch but also to the winch driver and other helpers caused by flailing broken wire, wire dragging across people, cars or other aircraft and unexpected launches associated with poor communications with the winch driver.

Aero towing is the most convenient and flexible method of launching and can be done at a pinch with only two people, the glider pilot and the tug pilot so long as the grass is short so that the initial launch can be done with one wing of the glider on the ground. Unfortunately it is also the most expensive due mainly to the high maintenance cost of the tug aircraft and to a much lesser extent due to the cost of aviation fuel. The maintenance standards for general aviation are proscribed by the Civil Aviation Safety Authority for OUR OWN GOOD and the safety of others. However there is nothing wrong with at least considering variations or alternatives to our current practices with the aim of reducing aero tow costs.

Powered hang gliders have already been used overseas and possibly also here in Australia as tug aircraft. They have the advantage of being quite simple structurally and the even greater advantage that their regulation comes under the Ultra light Federation rather than CASA, both of which should help to keep maintenance costs down. The tow point on a powered hang glider is quite close to the C of G which is an advantage because an out of position glider does not exert such a strong destabilizing force on the tug compared with towing by the tail. Finally the towing speeds are quite well matched to gliders compared to crop dusters which tend to tow a bit faster than the ideal speed for a glider. It is however quite good if the stall speed of the tug is slightly higher than the glider. It would be disconcerting if the tug took off and stated climbing away before the glider had got off the ground. Unfortunately powered hang gliders have two disadvantages which limit their usefulness as tugs: most are under powered for the job of towing and they do not enjoy flying in turbulent conditions. Since we want to launch when the thermals are strong this is a serious disadvantage.

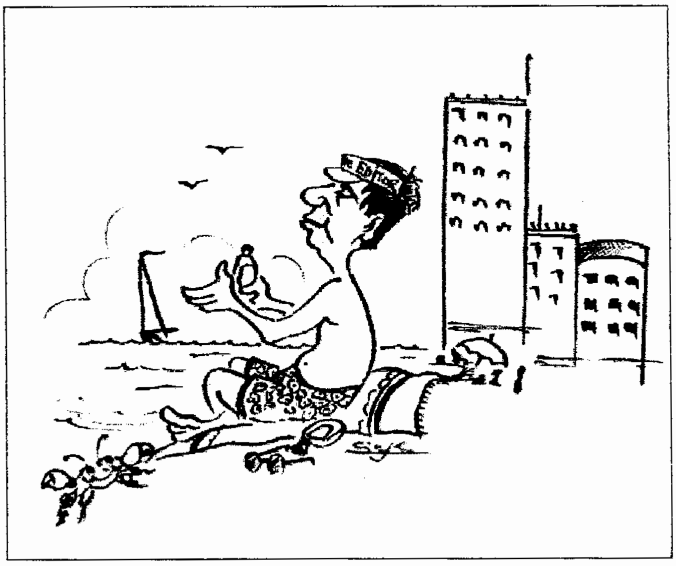
Perhaps a more conventional ultra light with normal control surfaces could overcome the control problem in turbulent conditions. I looked though Pacific Flyer and other publications looking suitable designs. The most likely to me is the Drifter, a wire braced high wing sailcloth covered monoplane with a pusher propeller mounted behind the wing. The Drifter can carry two pilots and has conventional tail surfaces and controls. With only one pilot aboard it should have sufficient power to tow single seat sailplanes. Best of all a second hand Drifter can be obtained for less than $20,000.

The greatest cost problem associated with aero towing can be blamed on the air-cooled engines of normal tugs which are basically unsuited to our type of work. Lycoming and Continental engines are quite powerful and are lightweight for their power output but they require rich fuel mixtures to assist engine cooling which does not help fuel economy and they suffer from cracking of cylinder heads due to the thermal shock of rapid heating and cooling associated with full power climbs followed by rapid descents which is the normal cycle in towing operations. To prevent cylinder cracking the tug pilot gets to fly all over the sky after releasing a glider while he waits for the engine to cool slowly. Not only does this mean we pay for a lot more tug time than we should for each launch but other gliders have to wait on the ground waiting for their turn which means they miss the best of the conditions if the day is fairly short. The engines also cost a lot to buy and to overhaul.

The answer must be water cooled engines which are made by the million for cars. I know that previous attempts to adapt motor car engines to aircraft have nor been very successful. However having seen a reduced scale Mustang replica flying at Mangalore with a small block Chevy engine of 350 horsepower I am convinced that they can work. The Chevrolet engine might not seem at first glance to be an ideal engine because it has an iron block and should therefore be fairly heavy. It does have several things going for it. Firstly it is a powerful engine which meets our main requirement. Secondly the engine has been extensively used for racing over a long period and hence there are a lot of parts such as specially strengthened crankshafts, con rods etc which are fairly cheap. A lot of work has been done to ensure that these engines can run at high power outputs for a long period of time.

A requirement for a successful car engine conversion is a reduction drive. This is because the car engine does not produce much power at the low revs required for an efficient propeller. It is also a good idea because the car crankshaft is not designed for the stress of a heavy propeller hanging on one end. The reduction drive takes care of the propeller shaft and also provides a good spot to place a suitable thrust bearing which is not part of a normal car engine. Fortunately there are a number of reduction drives coming on the market thanks once again to our inventive cousins the Americans (what would we do without them).

Having discovered a suitable engine and reduction drive it is necessary to find a suitable airframe for it. Ideally one would simply adapt some suitable existing aircraft, particularly if is being scrapped because of the recent fuel contamination problem. Unfortunately this is not so simple because as I have already said the Lycoming engine is light but the Chevy engine is heavy. Therefore if we put the Chevy where the Lycoming used to be the aircraft will be too heavy at the front so it has to be modified. Also all the other structures probably need to be modified and the aircraft recertified at the new higher weight. Can you image getting all this past CASA. The best solution is to start again with a new aircraft design which not only takes the new engine but which is also specifically designed for the role of towing gliders. The design must be simple, robust, stable and easy to fly and optimized to climb best at glider speeds, about 50 kts. Above all it has to be CHEAP! Luckily I have sketched a suitable design on the back of an envelope. It looks a bit like a Volksplane, which I also saw at Mangalore but is a bit larger to take the Chevy engine. Now if you all come round and help me build the new tug we should have the towing problem SOLVED!



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**SMILE**

Doctor, doctor. Every time I sit down, I see visions of Mickey Mouse and Pluto. And when I stand up. I see Donald Duck."
"How long have you been having these Disney spells?"

-------------000-------------

" Well. Mr Smith. I have got good news and bad news"
" What's the bad news?". Well we've amputated the wrong leg"
"What's the good news?"
" Your bad leg is getting better"

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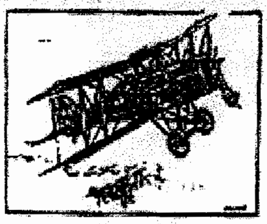

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