THE AUSTRALIAN HOMEBUILT SAILPLANE

Editor: James Garay

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Editorial

G'day mate!

Isn't it amazing how time is passing by so quickly. We are already at the end of another year and soon we will be celebrating Christmas and 2004…and on behalf of the team involved with the production of this newsletter: Peter Raphael, Peter Champness, Malcolm Bennett, Alan Bradley, Andre Maertens, Sergio Jacobi Nils Ake Sandberg, Eddy Garay, Virginia Garay, and Leo, it is time to wish you the very best for the season in the company of your family!

This issue is jam packed with great articles by Peter Champness, Sergio Montes, Andre Maertens, Alan Bradley and Neil-Ake Sandberg.

Peter Champness continues with Launching Gliders-Part 2. He also is reviewing a book about The Wright brother and the invention of the aerial age; a very interesting history to celebrate the centenary of his historic flight. One hundred years of aviation 1903-2003.

My friend Dr. Engineer and B.Sc. Sergio Montes to whom I've known very well for many years (50 plus) obliged at my request to write about flexible wing gliders…it's a very interesting read. Sergio is also the Editor of "Free Flight Quarterly" a magazine dedicated to those interested in building and flying model aircraft.

Andre Maertens from Queensland explains his views on glider trailers and cheap aerotows.

Far away from Sweden Neil-Ake Sandberg tells us about self launch gliders in his country.

Another year will soon be gone and I'd like to thank all those who have participated with articles and the like in this journal and past journals.

HAVE A MERRY CHRISTMAS AND A HAPPY NEW YEAR!

Address all correspondence to:

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Inside This Issue

MAIL BOX

Dear James,
Hi! In the Newsletter, please change the address for the SHA to: Murry Rozanky, Treasurer.
23165 Smith Rd
Chatsworth, CA.91311 USA.
Please send the SHA copy of the Newsletter to the new editor:
Andy Kecskes
6248 Spruce Lake Avenue
San Diego, CA 92119 USA
Thanks & congratulations on an excellent Newsletter!
Janice Armstrong.

Dear James,
Sorry about the delay on renewing my subscription. Enclosed is the amount for 2 years. Regards. Roy Glen N.Z.

Dear James,
Please find enclosed money order. Being annual Subscription fee. Regards. Derek Hardie

Dear James,
Please find the fee for my subscription to AHS.Newsletter. When will there be another week end, like we had at Tocumwal a few years ago? Regards. Jim Jensz.

Dear James,
I enjoy the latest issue of the newsletter. Many thanks to you and the rest of the team who produce such an interesting and informative publication.

One small matter though. About this time last year we moved into a retirement village near Frankston. I feel sure I notified you of my new address, but the most recent newsletter went to my old address in Frankston and was redirected by the post office. Would you please check your mailing list and ensure that I am listed at my current address, 70/8 Robinson Rd, Baxter, Vic. 3911. Ph (03) 5971-3319. Wishing you continued success with both your editing and your soaring. Sincerely, Allan Ash.

Eds Note: Dear Allan, first accept my apologies on the inconvenience caused for the wrong address, but the gremlins got into the system causing such a mess. Every thing has been corrected now.

Dear James,
Taking your invitation seriously I enclose a little tip for the newsletter. Maybe some one can use it in the near future.
As well, our little problem can be some where in the world. We must stick together against anyone who makes our lives miserable trying to get us grounded.

Self launching gliders are here to stay, but we can not just scrap the old ones. There is always a solution to any problem for "genius sailplane home builders"

Thanks! For an interesting newsletter and many happy landings to you all. We are just facing the Winter time up North Best Regards.Nils-Ake Sandberg. Sweden.

Eds note: Thanks you very much Nils for your contribution to the newsletter. Welcome aboard!

TECHNICALITIES

GLIDER CONTROL SYSTEMS
An excerpt from The National Gliding School manual

Control systems are the mechanical connections between the hands and feet of the pilot and the control surfaces of a glider. Correct functioning of the control circuits are necessary for the safety of the pilot and the aircraft.

As with any other machine a glider will deteriorate with use. The control circuits form the majority of the moving parts of a glider and are therefore subject to wear. This calls for the attention of the Ground Engineer who must see that maintenance is carried out to reduce such wear to a minimum and also to ensure that deterioration does not become sufficient to cause a hazard.

The design of control circuits has improve greatly during recent years as manufacturer are building better sailplanes which stay airborne longer. The modern pilot also requires a control circuit which is direct, with no sloppiness or backlash and little friction.

CONTROL CABLES
Control cables are wire ropes made up of continuous strands of high tensile steel or stainless steel wire. The individual wires are twisted together to form strands which are in turn twisted to form the complete wire rope or cable. British and American cables vary in their specification. British cables are specified by the nominal breaking load, the most common size being 10 cwt. (1120 lbs) which is of 7x14 construction/ (i.e.: Seven strands of fourteen wires each).

The equivalent American size is 1/8 inch, as the USA specification is by diameter, which is of 7x19 construction with a breaking load of about 1700 lbs.

Although air loads are comparatively light, loads exerted by the pilot or due to contraction may be high. For example a pilot can exert a force of 600 lbs. on a rudder circuit. For these reasons little deterioration in cables can be tolerated.

Cables are used as tension members, mainly to operate levers. Where two-way operation is required a pair of cables are necessary. Fitting usually end in a thimble and the cable is tied back on itself with a splice or metal swage. Turnbuckles are used to vary the length or the tension in the cable.

Cable deterioration can be caused by wear, corrosion, internal fretting, fatigue and overloading. Wear is caused by the cable rubbing against a fairlead or part of the structure. This can be very serious as a large number of wires are exposed on the surface in a short length and ultimate strength can be almost halved if the surface wires are worn halfway through.

A cable should not be thought of as solid rod which would suffer little reduction in strength from a similar amount of wear.

Corrosion is a result of water penetrating into the cable. The cable should not be painted as this will prevent the moisture evaporating. Internal fretting is due to relative movement between the wires inside the cable. This wears flats on the wires over a period of time so that cables do wear out and should be replaced after 5 or 7 years of use. Internal wear can also occur if the cable is greased and dust and grit becomes introduced. It is a matter of debate whether cables should be greased or not.

Fatigue is a result of flexing the cable around a pulley. In general the smaller the pulley diameter the greater the chance of trouble.

PUSH RODS
Push rods are usually made from mild steel tube and transmit tension and compression forces. In modern aircraft the pushrods are usually fitted with adjustable ball ends, ball joints or self aligning bearings. Push rods usually cost slightly more due to the expensive rod end used but they never require adjustment and will last out the life of most gliders.

WHAT'S NEW

SELF LAUNCHING GLIDERS
By Nils Ake Sandberg.

If your choice is a Grob G-109B or a SF-25C, you have many features that aero-tow or winch can not provide.

One man handling all the way into the thermals makes a better access. In Sweden, we do nearly all the maintenance ourselves at the club and we can manage any problem in a better way.

In our motor glider we have a power plant made by Limbach and it is similar to the Lycoming aircraft engine in many ways. It is old fashioned and has a magneto system for ignition.

Limbach is originally s car engine, which performs worse than the original car application due to the need for at least 20.000 Volts to ignite the sparks in cold conditions.

The magneto system can not provide this so the engine needs to be warmed up below zero degrees centigrade. A conventional oil heater for cars is used for heating purpose. The engine runs very bad in comparation to an injection and ignition controlled modern car engine.

The Limbach 2400 engine, which is bored up to 2.5 lts by Grob, gives 90 H>P to a feather able propeller.

It starts to leak at the cylinder top due to the pressure on the tightening areas are on the low limit.

The cylinder top covers two separate cylinders at each side of the pancake engine. Grob solved the problem by a steel ring as tightening at each cylinder top.

The problem is; it is leaking around the steel ring, making a ditch in the top tightening area. You have to take away material on the tightening area until the ditch is gone. Rings of did not work either and all the efforts done to it through the years seem endless. These take a lot of working hours at least once a year.

Suggestion of using a top tightening from an ordinary car engine and remaking it for use in our engine, was a new twist in the 21st century.

We found out that a VOLVO B23 cylinder top tightening would do the job a bit modified. We bought two sets and cut two rings from each in only four hours of labor.

This solution worked well for nearly two years until one of the rings gave in. The ring was broken, but the ditch we used to see was not there, so an improvement was clearly made.

The broken ring told the story of to little pressure put on it. There are eight bolts, four at each cylinder and they are drawn at a momentum for an M8 nut. We mounted new rings and draw the top twice after a short engine run in between. On the winter's service, we have to redraw the tops again every year to see if there will be a development in time beyond the two years limit.

Summing up:
The problem is the up drill rebore to 2.5 litres would have needed a 5th bolt per cylinder. At least it would be nice to leave the M* for an UNF 3/8" much finer thread. The coarse thread worsens the problem due to the nut friction is not good enough in these application. Maybe a washer could do the job, but are not common on engine tops.

If you try to place a pin from case, there is a warning that it may leave the case unusable in the maintenance manual. It can be very expensive.

Any way, it is clearly a soft lightening, which is needed in our application so we are on our way to less man-hours involved in this problem.

Freedom of soaring
With self launching glider or the TMG's (Top Motor Glider) the freedom 0of soaring becomes finally a reality.

TMG's are also used for aerotow and for example, SF25C's 65 HP is increased to 8o HP and will do the job excellent. There are also alternative engines to install from Rotax. Per example (Bombardier Rotax)

There are many unpowered sailplanes left, so this is a survivable way in short term. When the tug is out of service, also are all the gliders if we do not change the situation. Our Swedish authority LFI approved the plans for this situation in 2001 and they are similar to the plans for aerotow with powered planes. So far we have tug pilots with only glider's pilot licensed.

Where are the Sailplane Homebuilders in this soup?

Sailplane home builders are like inventors and do things smother and better functioning but not necessarily in a well designed way. That puts a pressure to professionally made sailplanes not to put fantasy prices to their products.

At least 60% of the world sailplane will be homebuilt due to high cost in development and authorization. When the soaring activity

drops, the homebuilding rises, at least it is so in Sweden.
In our club we do not like the always wrong mentality of redoing things who do not work, time after time.

There are limits you can not bypass in engine development and so far Grob have not come up with a better solution

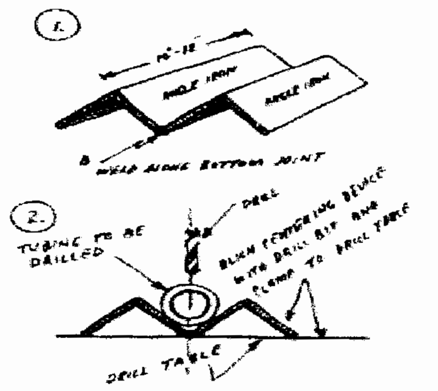
Quality seems to be; once wrong, always wrong.

HINTS & TIPS

CENTERING JIG FOR DRILLING TUBING

An excerpt from the book" SPORT PLANE BUILDER"
By Tony Bingelis

Take two 12 inches lengths of any common size angle iron (1.1/4-inch x 1.1/4 inch x 1/8 inch was used for mine), place these two pieces side by side and tack weld the ends where they touch. Turn the angles over and finish the welding by running a bead down the center joint line. After the work has cooled, grind the weld line as necessary to permit the device to lie perfectly flat on a level surface.



Centering Jig for Drilling Tubing
Figure 7

To use the drilling jig, it must be clamped on the drill table and centered under the drill bit. For clamping purpose , you might want to weld on a tab or two directly to the jig. In most cases, you can just slip a "C" clamp over one end of the device.

After the jig is clamped to your drill table, insert a small drill bit in the drill chuck and lower the bit until it just touches the jig. Now, move the centering jig around until the drill bit is centered over the center line of the jig. Tighten the "C" clamp and you are ready.

To drill any pipe or tubing, first make your punch mark as you usually do, and then lay the tube in the "V" groove of the centering jig. Drill completely through the tube as needed. The jig will automatically insure that your hole is centered in any size tubing.

ONE MAN RIGGING

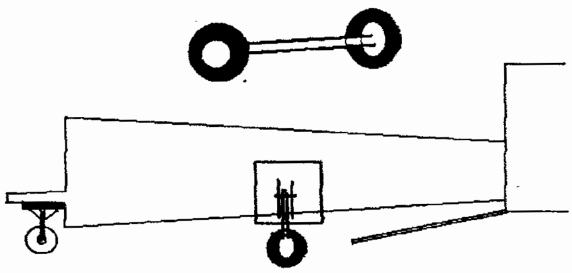
By Peter L. Champness

Various devices have been devised over the years to assist the process of assembling a glider. The method adopted when my glider trailer was devised was 4 strong men (or Women), anxious and willing to help. That was quite a good method. Unfortunately they can be difficult to find these days, especially when wanted.

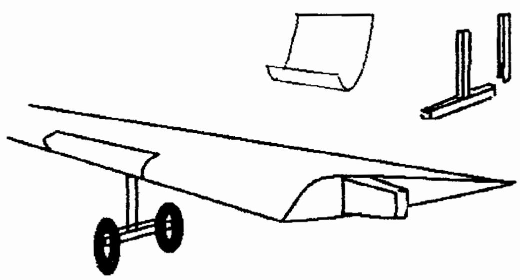
One idea which has the potential to assist the glider rigging process considerably and replace at least two of the strong men is the wing transporter. This is essentially a quite simple device which incorporates some clever ideas. It is remarkable in some ways that it took so long to think of it before now. Good ideas are quite hard to come up with I suppose. I expect that they will be very popular and become quite widespread on a short time.

I have attempted to explain the wing carrier for one man rigging in a previous news letter. The idea was not one of mine. I heard about it from John King at the Gliding Club of Victoria and also Eugene Blunt at Corowa. James Garay also sent an article from the American Homebuilders Magazine by Ralph Lubeke. Ralph makes glider trailers and was kind enough to publish his plans.

The basic idea is that the wing is carried at its centre of gravity, on a type of two wheeled trolley. The wing is wheeled part way out of the trailer on its wing spar dolly, and then lifted onto the wing transporter whilst still in the vertical position. The wing can then be wheeled into position by one person, and rotated into the horizontal position. The platform which carries the wing hinges on a bolt at the top of the post. The wing can then be advanced until the wing root engages with the fuselage fittings. If the wing is placed on the platform so that it is slightly heavy at the root it will then stay on position, resting on the fuselage junction whilst a trestle is fetched and placed under the wing tip. The wing transporter can then be removed and used to carry the other wing into position.



Wing Transporter in position after wing partly removed from trailer



Wing has been rotated into the horizontal position ready to nmate with fuselage

A jack is provided to adjust the height of the wing. The jack is used to raise or lower the second wing until the wing spar fittings are perfectly aligned. This is usually a difficult time in the rigging process, partly because the person holding the wing tip has to hold a heavy weight in an awkwardly high position and starts to tire rapidly and partly because two many cooks spoil the broth. With lots of advice on what to do the wing pins seem not to want to go in! With the wing transporter carrying all the weight there is no need to panic. Small adjustments can be made to the position and height of the wing until the fittings are perfectly aligned and the pins can just be popped in. With some practice the glider can be rigged by just one person, but some extra devices are required such as a fuselage dolly to hold the fuselage upright and a wing stand. It can also be a bit difficult if it is windy, in which case some helpers are handy.

I have now almost finished my version. The frame is made from 30 and 35mm square steel tubing with 1.6mm wall thickness. These tube sizes are a good sliding fit. The wheels can be obtained in most hardware stores for $15-25 each. The jack is a bit harder since this type of jack is not used much any more. A Mercedes Benz jack is nice and has bevel gears. Mine is a much cheaper type, possibly from a Morris Minor. Start looking in garage sales for a suitable jack!

The upper platform is made to suit the wing. A universal type can be devised. I made mine from plywood because I found some suitable wood being thrown out. A fiberglass platform could moulded directly from the wing and I might do one of those in version two. Some parameter\s are still to be sorted out. The height of the transporter has to match the height of the wing on the fully rigged glider. The C of G position of the wing has to be established and the hinge bolt placed at about the correct position. It is best if the wing is slightly trailing edge heavy when in the horizontal position. The triangular wooden block holds the platform level and stops the wing from tipping trailing edge down and falling off backwards. The transporter still needs an adjustable clamp at the back to hold the wing firmly and prevent the wing from falling off.

The total cost off materials so far is less than $70. By comparison Cobra Trailers sell a fully made up version if you don't want to build your own. It has a neat jack built into the vertical stem. It costs about $900 Euros which is about A$1800.

AIR CUSHIONS

By Peter Champness

In the process of Glider Inspection or Maintenance it is often convenient to place the wings or fuselage on stands or on the floor. The glider structure is amazingly tolerant of misuse during this exercise. I have seen wings propped on a steel stand made of railway track protected by nothing more than a piece of carpet yet apparently suffering no ill effects. One does not however want to damage ones pride and joy and hence there is a tendency to place cushions under the parts to spread the loads and prevent damage. Cushions are fairly readily obtained from the roadside because people throw them out from time to time. I had a good collection of cushions but I was running out of space in the shed. By their nature cushions take up quite a bit of room! Mt wife also thought the stained, dirty and partly rotting cushions looked unsightly. The cushion collection therefore had to go.

I was therefore looking for an inflatable cushion which could be deflated after use and folded up and stored away. The air cushion has the further advantage that it conforms to the shape of the structure and spreads the loads even better than a conventional cushion. If the cushion is large enough the air pressure within is very low. Some years ago an air cushion was marketed as a car jack. The bag was place under the vehicle and inflated with the car exhaust pipe by running the engine. The device is not being sold now, probably because it had disadvantages (such as the car rolling off the cushion if it was used on a slope). The air cushion is also subject to punctures. The cushion effect is completely lost when the air leaks out!

The very compact nature of the deflated air cushion however outweighs the disadvantages so it was time to spend some money. A lightweight air mattress was obtained from Crazy Clints (where else!) for $3.99. The air mattress has two compartments, a small pillow section and the larger mattress section. I mainly wanted the pillow part. Since this is a separate sealed compartment it can be cut off from the rest with a pair of scissors.

I did not want to waste the rest. I had cut through the ribs of the mattress so the end needed to be sealed up again. This is easily done with an iron. The plastic mattress was placed over a thin wooden batten and the iron run over the surface. The heat was gradually turned up until the plastic just melted and sealed the edges together. This worked well so now I have two air cushions for the price of one.

WARNING! DON'T use the iron directly on the plastic because it will melt and stick all over the base of the iron. Place a piece of brown paper between the iron and the plastic. Newspaper is also OK but the ink does come off onto the plastic and onto the base of the iron. If you are using your wife's iron (or maybe even your own in these days of Men's Lib) and you have used newspaper give the base of the iron a good clean afterwards otherwise the printers ink will get all over the next lot of ironed clothes!

Dear James,
As you know for the last 6 years I have been an active Hang-Gliding pilot, and before that flew for 10 years as a sailplane pilot.

My lack of youth and the risk of injury, witnessed amongst my HG friends, has caused me to reconsider and withdraw my involvement with HG.

I miss flying terribly, nevertheless having experienced the thrill of low level (relative to sailplanes) flights and the maneuverability of light by loaded H G, I am very attracted to light weight (ultra-light) sailplanes. I was keen on the Woodstock for a while and very excited by the Carbon Dragon that was demonstrated by Graham Betts at Bacchus Marsh (was it the year 2000at the AHS Symposium?).

Another design that interested me is the "GOAT" designed by Mike Sandlin. The full constructional drawings are available free on the WEB.

It is a high wing monoplane of primary glider style that uses modern materials as used in Hang Glider construction. Performance is modest in L/D but its flying speed is low and climb rate excellent. It can be carried on a car top. For Australia I suggest a trailer for longer distances and the use of HG car towing techniques using polypropylene rope and tension gauge; as we do not have many suitable slope launching sites available, thought slope soaring is it forte.

I could build the GOAT but it (like the Carbon Dragon) does not fit in normal gliding operations, nor does it fit into normal Hang Gliding operations (3 axis not weight shift control)

I do not have the skill to design a new type nor do I have the dollars to buy a TeST, SWIFT or SILENT.
I know you have mentioned that it was difficult to organize another Symposium, but is there a way to get similar ideas about ultra-light sailplanes together?

I would be keen to facilitate if there is enough interest!
I would also like to hear from other potential "GOAT" builders. Cheers.Dete Hasse.(recumbent-no longer prone pilot)

Eds note.
Thank you very much for your offer to make yourself available for another symposium. I will contact you if we decide to have one in the near future, first we have to solve a very serious problem, it is legal liabilities. As you know we are a group of interest we do not have office bearers, to be legal, we have to be incorporated and that costs a lot of money.

SHOP TALK

SOMEWTHING ABOUT GLIDERS TRAILER AND CHEAP AEROTOW.
By A.Maertens

Thanks you for a really good newsletter. I'd like to point out a few helpful hints.

A) In regard to trailers and side wind effects, Dr. Champness has suggested several improvements, please allow me to improve on those as well.
B) The new front should be "V" shaped as it is on Dr. Champness drawings there is an awful lot of down trust created by the wind blasting over the roof of the car and onto the flat surface, a "V" shaped panel will deflect the air either side of the trailer body.
C) The round roof is very good.
D) The formula is very simple, the axle should be back from the centre of the load platform to the rate of 300 m/m of overall floor length.
E) The inclusion of an adjustable draw bar is another plus. I have built around 100 trailers over the years and never made a draw bar shorter than 1.8 m from the front of the leading platform to the centre of the tow coupling.
F) The spare wheels go behind the mudguards and protrude lower than the floor by near 200 m/m.
G) Any tool boxes, rope boxes I mount on the front of the axle.

On the subject of aero tow I think Moyes has a tug called the Dragonfly designed as a towing machine, a quick phone call will give you all the information required, an that plane powered by a Subaru would be excellent.

On the subject of auto engine conversion for a proposed aero tug I must strongly suggest the use of a Subaru engine; an EA-81 develops 100 HP via Amax reduction. The EA-82 develops around 150 HP with a few improvements.

Any one wanting to know more on that conversion only needs to look at the popularity of that brand of engine in the ultra light aviation field.

Those engines have an excellent power to weight ratio far superior to any Chevrolet conversion. An EA-82 can be made to develop 300 HP so why use a lump of cast iron? As to reduction drives my experience with ultra lights suggest that a Gilmen belt reduction will work well up to 150 HP any higher I would convert a Kombi rear axle reduction that will take up to 300 HP.

So there you are dear Editor my small contribution to the next newsletter.

Pass my regards to your team Dr. Champness, P. Raphael (The Erudite) an M. Bennett.

SUMMMER CAMP 2004

Next year 2004 again we are jointing our cousins from the AUSTRALIAN VINTAGE GLIDERS for the summer camp, the venue will be at the Bacchus Marsh Airfield from 3 - 11 of January 2004.
Bacchus Marsh Club house has excellent facilities to make every one happy, camping is available and catering will be provided, as well aero tow and winch.

MORE BRADLEY RAMBLINGS

By Alan Bradley

I thought it was about time to provide you with an update on my Woody. I have been back about four weeks now from my obligatory twelve weeks up north. It is well worth while putting up with three months of 23 deg sunshine & beach girls in exchange for eight or nine months of isolation in my cold workshop---the ultimate sacrifice.

Every thing is coming together quite nicely now. I had an inspection by Redmond Quinn on my spars last week prior to closing the up and today I glued the last piece of ply in position-----quite a pleasing feeling. This afternoon my wing centre fittings were delivered after having them heat treated to 125000 p.s.i. by Hills Heat Treatment in Bayswater [Melbourne] . I found them very good to work with especially the price of $76 which included a CASA certificate..----much better than the $700 which a mob up in Brisbane wanted. Incidentally I took the fittings away with me to Queensland & finished them off at Maroochydore [I had jig drilled them before leaving home].

As you all know there is plenty of time to use up while waiting for epoxy glue cure & this gave me the opportunity strip up all of the wing timbers & do other jobs. Incidentally I do nearly all of my sawing on my band saw just as Peter Raphael (The Erudite) described in the last newsletter. In fact I would not be at all surprised if the saw in his photo is an old Mc Pherson just like mine which is a very robust machine.

The first job I did when starting my Woody two years ago [including three holidays] was to cut out all the wing ribs. Since getting home I have finished gluing on all the doublers & profiling them. Fully dimensioned sketches for the wing assembly jig are now completed and construction will start in a few days I will be building both wings at the same time so hopefully progress will be reasonably quick. I have also prefabricated the trailing edge with bottom ply gusseting.

I keep on intending to ask if anyone has found a way to extract staples from tack strips in one operation? I have achieved it a few times but have settled on two operations----the first to lift fifty or so with a ground down wood chisel ----the second is to extract them with a ground down pair of pinchers. As I release the staple I catch it with a small magnet. The operation goes fairly well but is still a pain in the proverbial bum. If anyone does it quickly in one operation I would be very pleased to hear from you [08 81651042].

The big news is that Mal Bennett has offered to sell me one of his 3 cylinder Konig motors. Mal has considerable experience with these on his Monerai and they only have 18 hours since overhaul. Also Peter Raphael has offered to send me details of their latest thinking on trailer construction. I GRABBED both offers.

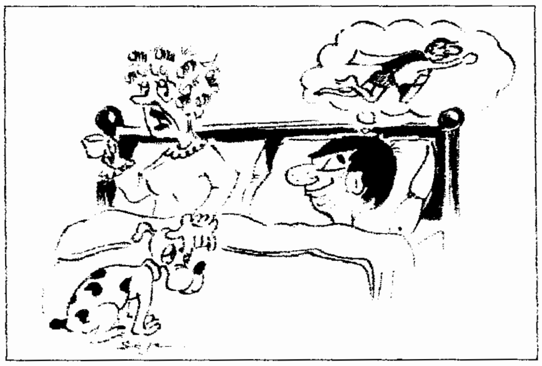
I have said it before and I'll say it again----thanks to the AUSTRALIAN HOMEBUILT SAILPLANE and especially Mike Burns and the Melbourne group of Woodstock and Duster builders. At the moment I feel like the juggler with all the balls up in the air, trying to decide which one to catch next

IT HAPPENED TO ME

BUILDING YOUR OWN SAILPLANE

By James Garay

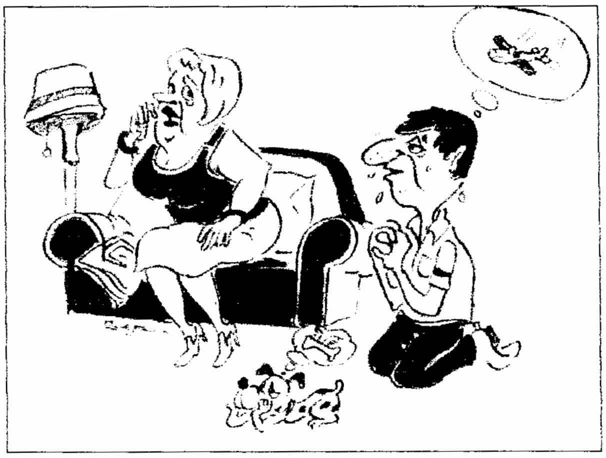
How many times have you been dreaming of building your own sailplane? How many nights has your adventurous mind engaged you on a flight of fantasy flying high among the eagles in the infinite sky?



Well...... this and many other colourful situations occur in the midst's of our grey matter.

Finally, the day has come, this is the time that you have decided to build your very own special glider, one that will be for your own personal satisfaction and greatest pleasure. It has happened to me, believe me, I am speaking from my own experience and tribulations.

The story begins when you decide to make a comment to someone of your intentions, and then you announce that you have decided to build your ever lasting dream. The first person you will announce this to, will be your wife (***if you are married, that is***) or perhaps your girlfriend ***(unless you are single)***.



The first reaction if you look straight into their eyes, will be a grand expression of disbelief and more accurately it will be complete amazement. You will be able to read their faces of what they are thinking, that something is terribly wrong with you, or you are no longer of this world, you may have perhaps been kidnapped by aliens and have been brainwashed.

The following stage will be, your wife will call for a secret family meeting (***like the Pope conclave***) with the children including the most important member of the family which is (***the family pet***.), yes, the one with the loyal eyes, the one that never complains. All this happens without your knowledge....... but soon you will notice that your children are looking at you with some kind of compassion and disbelief. Dad has gone absolutely mad! they will say to their friends.

All these reactions will not happen if you have an understanding and compassionate wife.

She'll only say....It's OK Dear! (***For one moment.***) but ...wait... there is trouble looming in paradise, when you start to use the kitchen, the dining room, the lounge, the rumpus room etc. etc. OH.....my god!!!.....what a mess, she will say.

Then you will be in dire straits and enormous trouble. No one in your family will talk to you and you will become the invisible man. When you arrive home in the evening after stopping at the "TWO DOLLAR SHOP" or "CRAZY CLINTS" warehouse to show them the bargain tool that you found to build your sailplane, blank stares and crazy smiles will welcome you.

The only thing unchanged is that your ever loyal friend "LEO" (***your family pet***), will wiggle his tail as sign of approval. Little does he know!!

If you have a girl friend on the other hand, at the beginning she will not believe you, but after, when you are serious about your project, she will argue with you about the time that you are not spending with her, she will give you an ultimatum. She will take a flight......one for good!!
Like Shakespeare... ***"To be or not to be".*** "That is the question."

So...... so far so good..! and you, still with the intention of building your own sailplane? After all this?....... Just let me tell you, when there is a will there is a way.........and a hard one at that.!! Well let me continue with this saga.......
Why do you want to build a plane? Why don't you buy one already built or perhaps a second hand one?
I am sure, your answer will be........I do not have sufficient money!

By the way, I should tell you a story, since I was a little boy 10 years old, ***(long, long time ago)*** I have always been interested in aviation and building model airplanes, since my father bought for me as a Christmas present a plane kit. I remember it very fondly and very clearly. It was The Consolidated PT biplane trainer, made by the American company "COMET" which no longer exists. I am recalling my memory back to 1942 and I recall my father and I trying to assemble the kit, it was finally completed after a while and I was the most happiest kid in the world.

I was ecstatic watching the first flight under the rubber powered motor and many years after the same scene was recalled when I was flying my "Woody-Roo" for the first time.
But this time was different! I was at Tocumwal airfield with my friends; Malcolm Bennet, Mike Burns, Peter Champness and "The Erudite"Peter Raphael.

As I am getting older, the emotion appeared in my eyes and one tear drop fell from my watery eyes. Memories are a great thing! So!....are you feeling the same as me, like an eagle waiting to soar?

You must have the same indestructible bug in your blood, so go for it and have fun building your dream machine!

Do not take any notice of what your friends are going to think about you, they do not know understand the feeling, the emotion that you will experience in your inner self.

But, there are two very important points to take into account:

One, you have to have a talk with the Finance Minister and try to convince her to give you the approval.
Secondly, start winging that you do not want any more socks for your birthday, shirts for father day and two dollars shop presents for Christmas season.

Instead tell them that you will be very pleased to receive gifts of the metal kind, those which are used to cut, grind, polish and so on, and tools that you are going to need during the construction of your dream machine. They may even offer to give you a donation instead so that you can spend time browsing at your local tool store...***now wouldn't that be great!!***

I can assure you, this is one hundred per cent successful!!....it works!! ***It happened to me!!***

FREE FLIGHT QUARTERLY

To those interested in model aircraft, there is a well recognized international Free Flight magazine with contributions from many top competitors and designers. Free Flight Quarterly present in depth articles on technical topics as well as designs and plans for many specialties within Free Flight: the FAI categories Scale and Vintage models but also including HLG and indoor topics.

Engines are well catered for, including spark ignition and older designs.

Free Flight Quarterly has been born from the desire to have an international English language magazine devoted exclusively to Free Flight matters. Although FFQ may not be the only one of this type, it will publish longer articles that, by virtue of their intrinsic interest or technical complexity, are not published elsewhere. Free Flight Quarterly follows in the noble tradition initiated by Andre Schandel with Vol Livre in France, Bernd Schwendesmann with Thermiksen in Germany, and Ian Kaynes' Free Flight News in England in the web site:
http://www.chariot.net.au/~bluejay/freeflightquarterly.html
you can explore the contents of all the issues of Free Flight Quarterly and the personalities behind them. You will also find forms for easy subscription and the available back issues both in printed form and CD's. The subscription rate of Free Flight quarterly is $25 AUD, for four issues per year, postpaid in Australia and NZ. $25 US outside Australia and NZ.
Correspondence regarding the magazine and subscriptions should be addressed to:
Free Flight Quarterly. 37 Windsor St. Kingston Beach 7050. Tasmania. Australia.
Or to the Editor: Sergio Montes at: montes@tassie.net.au.

SMILE ☺

Editors note: By members demand this section is just for your enjoyment, and to break the reading monotony, if you don't like it, simple don't read it.. but don't write or ring me about it. Members contribute to this section.

One hundred per cent (100%)

Ever wonder about people who say they are giving more than 100%?
We have all been to those meetings where someone wants over 100%.
How about achieving 103 %? Here is a little math that might prove helpful...
What makes life 100'% ?
IF:
A-B-C-D-E-F-G-H-I-J-K-L-M-N-O-P-Q-R-S-T-U-V-W-X-Y-Z
Is represented as:
1- 2- 3- 4- 5- 6-7- 8- 9- 10- 11-12-13-14-15-16-17-18-19 20-21-22- 23- 24- 25-26
Then:
HARDWORK IS:
8+ 1+ 18+ 4+ 23+ 25+ 18+ 11= 98%
KNOWLEDGE IS:
11+ 14+ 15+ 23+ 12+ 5+ 4+ 7+ 5= 96%
but
ATTITUDE
1+ 20+ 20+ 9+ 20+ 21+ 4+ 5= 100%
and
BULLSHIT
1+ 21+ 12+ 12+ 19+ 8+ 9+ 20= 103%
So it stands to reason that **hard work and knowledge** will get you close. **ATTITUDE** will get you there, and **BULLSHIT** will take you over the top.

But look how far **ASSKISSING** will take you!

ASSKISSING
1+ 19+ 19 +11+ 9 +19+ 19+ 9+ 14+ 7= 118%
So the next time someone asks you to give more than 100%, you will know what is required of you!

THE S-2-A AFFAIR

By F. Salazar

It was October 1989 while holidaying in Hawaii with my wife that I had the opportunity to meet a very important person. Mr R. Snaider. He was the only owner of a S-2-A flying in Hawaii. After a long and interesting conversation he asked me if I would like to have a flight in his motor-glider.

It was an offer to good to refuse and it was gladly accepted!

I had a flight that lasted more than a half hour and I enjoyed the fly like a kid with a new toy, I found that the S-2-A is a very easy to fly aircraft even when the take off took a little bit of the air strip due to the motor lack of power . The motor glider got airborne after a run of 1000 Mts. And the landing gear in tandem configuration made it more difficult due to a cross wind situation.

Also, the wing incidence for the first three quarter of the wing is Zero Degrees which make the take off longer, to all of this, the motor position is in a pusher configuration making the aircraft to stick to the ground.

The rudder has very low response and in my opinion it needs more area as well the ailerons it improve the efficiency.

The Center of Gravity (CG) is a little far back, in a dangerous position, it can be solved moving the pilot's seat forwards and adding weight in the nose area of the fuselage.

The landing in a cross wind condition is like a Russian Roulette due to the rudder's low area. During the landing the aircraft had to be complete paralleled to the air strip avoiding the tail touching the ground before the tandem landing wheels.

The take off without a wing tip helper is very dangerous, the horizontal stabilizer is very close to the ground.

The motor glider S-2-A is an aircraft pleasant to viewers but needs some modifications to make it reliable and stable.

Back in Australia I contacted Alex Strojnick via telephone and he told me that due to a few problems created by F.A.A. he ceased selling the drawings and he added that he sold two set of plans to some body in Australia, he only remembered one name Des Muir (ex resident of Grafton) who with his friend Mark Fisher where making the molds for the fuselage with some modifications to improve the performance

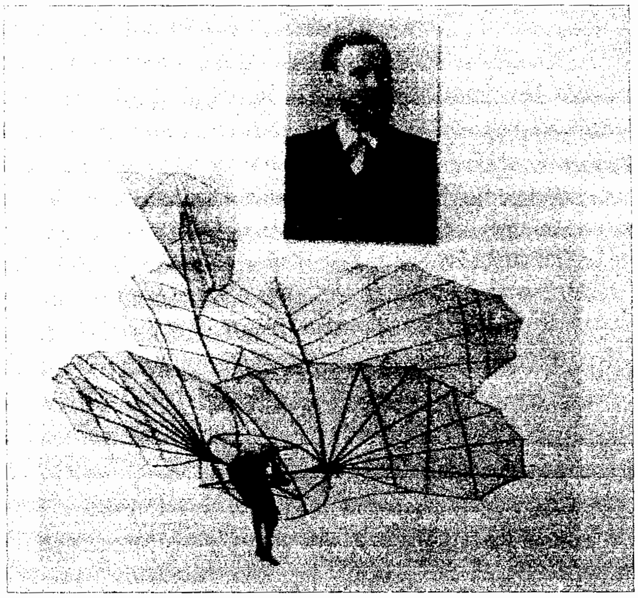
BOOK REVIEW

By Peter L. Champness

THE WRIGHT BOTHERS *and the Invention of the Aerial Age. Smithsonian National Air and Space Museum/ National Geographic 2003.*

'***The Wright Brothers – and the invention of the Aerial Age*** is published by National Geographic but appears to be a joint venture with the Smithsonian Museum.The authors Tom Crouch (senior Curator) and Peter Jakab (Chairman of Aeronautics Division) are both Associated with the Smithsonian National Air and Space Museum and have both previously published books about the Wright Brothers. The present volume seems to incorporate much of the previously published work and is well illustrated with photographs. Many of the photographs, particularly those of the Kitty Hawk field trips were taken and developed by the Wright Bothers themselves using glass plate negatives. The publication is timely given that the 100th anniversary of the first controlled powered flight by a heavier than air flying machine occurs on 17th Dec 2003. The place was the sand dunes called Kill Devil Hills, at Kitty Hawk, North Carolina, USA. The pilot was Orville Wright, flying time approximately 12 seconds, distance 120 ft.

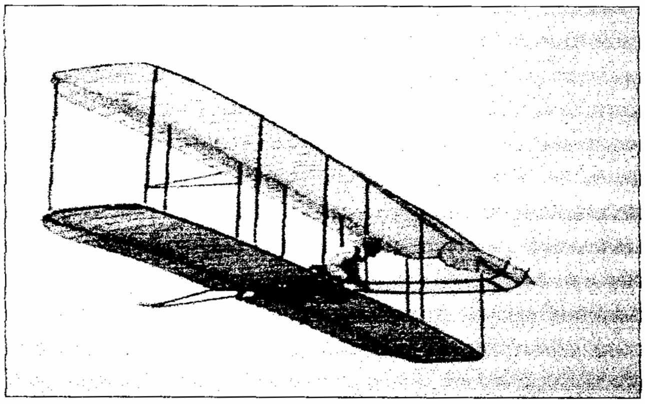
Wilbur (1867-1912) and Orville ((1871-1946) were the third and sixth children of Milton Wright and Susan Kroener of Dayton, Ohio. Twin were born after Wilbur but both died soon after birth. Two older boys Reuchlin (born 1861) and Lorin (born 1862) married and established there own families but Wilbur and Orville never married and remained at home. Together with their younger sister Katherine with whom they were very close since early childhood and their father, they remained a tight family unit. Following the death of their mother In 1889, Katherine (then aged 15) took over her mothers role of caring for the family. Her role in the eventual success of Wilbur and Orville's work should not be underestimated. Indeed, the fact that they had a secure and emotionally supportive family base and freedom from the distractions and cares of raising their own families gave the two boys a great deal of time to devote to their project that they otherwise might not have had. Their association and partnership was particularly productive. They understood each other well and shared a similar approach to problems and outlook on the world. They were able to encourage each other and stimulate good ideas and results from each other. If either had married it is most likely that this partnership would have broken up and success in the flying machine endeavors would have been unlikely.



Milton Wright was a clergyman with the United Brethren in Christ. He had a very conservative religious outlook but rose steadily thought the church ranks from circuit preacher to bishop. Milton Wright was the focus of deep divisions within his church. Rejecting utterly the progressive views of others who wanted to allow the membership of Freemasons within the church he eventually lead a breakaway group as a separate church and spent much of his time in litigation over the ownership of church property. Milton Wright was a man with a conviction about the absolutes of right and wrong. He taught his sons to be self reliant, industrious, honest and straight forward, able to ignore skeptics and look rivals in the eye. They both possessed absolute self confidence and were uncompromising and somewhat mistrustful of others, qualities which were helpful in their quest to achieve manned flight but which may have added to the extended disputes and litigation with rivals, competitors and others which followed.

Their mother was the daughter of a farmer and carriage maker. She was well educated and had quite an interest in mechanics and was capable of making items such as sleds and toys. They boys appear to have inherited they mechanical aptitude from their mother. Milton Wright by comparison was apparently unable to hammer a nail in straight.

The family moved a good deal when the boys were young due to their fathers clerical duties. In Wilbur's final year at school a rather sudden move was required due to his fathers involvement in the church disputes. As a result Wilbur was unable to complete course work required for his graduation. The family settled in Dayton and rather than repeat the year Wilbur elected to enroll in a series of college preparatory courses for entry into Yale University as a divinity student. These plans were dashed when Wilbur was struck in the face by a stick during a game of ice hockey. The degree of injury is not specified but it seems to have been followed by a series of rather vague medical problems diagnosed as digestive problems and palpitations of the heart. Wilbur spent the next 3 years as a recluse at home in a deep depression. The cause of his problems seems to have been depression, perhaps triggered by the failure of his previously very good academic progress. A similar but much more extreme condition is reported in Japanese school children. The 'Hiki Mori' children are so withdrawn that they refuse to leave their bedrooms, sometimes for years at a time. His time was not entirely wasted however. He read widely in his fathers library and cared for his mother who was suffering from Tuberculosis and who died soon after his recovery in 1889.



Wilbur emerged from his depression at the time that his Father was preparing to split from the main Brethren church with his smaller breakaway church. His mother died and his sister Katherine was encouraged by her father to assume the maternal duties (indeed it seems he more or less insisted) and the family unit was established as a bastion of support against external foes and competitors. Wilbur joined his brother in partnership, firstly setting up a printing business and later when the printing was going well they hired help in the print shop and started a bicycle repair and sales shop. Both business gave the boys extensive practical experience with machinery, mechanics and materials. They made some innovative mechanical alterations to the printing press and the bicycles gave them some important insights, particularly into the physics associated with motion and machine control. The process of riding a bicycle is usually quickly learned (and never forgotten so they say) but balancing and steering a bicycle requires a complex interaction of leaning and steering and forward motion. A bicycle is not stable at rest or on its own but is none-the –less controllable and is quite thrilling to ride once the skill has been mastered.

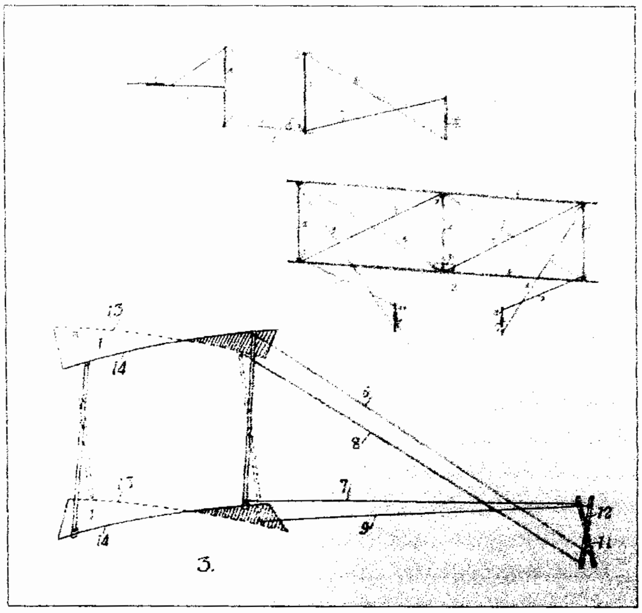
The printing and bicycle businesses were going well but Wilbur in particular was not satisfied. He needed some greater challenge against which to measure himself, perhaps a result of being frustrated in his academic career. Both Wilbur and Orville had been interested in flying since their father had brought home a small mechanical helicopter toy powered by a rubber band of the type devised by Alphonse Peraud. The boys played with the toy helicopter until it broke, they built their own copies. Wilbur had also kept up some reading in the field, particularly about the exploits of German gliding pioneer Otto Lilienthal. Lilienthal had made thousands of gliding flights in a series of elegant hang gliders of his own design and his exploits were widely reported. He had published some of his work in his book, 'Bird Flight as the Basis of Aviation'. The news of Lilienthal's death in 1896 in a gliding accident stimulated Wilbur's interest further. In May 1899 Wilbur wrote his now famous letter to the Smithsonian Institute requesting advice on useful references on the progress of aviation experiments up to that time. The Smithsonian replied with a number of references, the most useful being Octave Chanute 'Progress in Flying Machines' and 'The Aeronautical Annual' for 1895, 1896 and 1897 edited by James Means which included virtually everything written on the subject up the death of Lilienthal.

The Wrights had entered the Aviation field at a propitious time. The English aviation pioneer Sir George Cayley had commenced a systematic program of aeronautical research at the start of the 19th century. Cayley defined his concept of an aeroplane as a machine with fixed wings, a fuselage and a tail, with separate systems to provide lift, propulsion and control. Cayley had flown a successful model aeroplane in 1894 and had later built two full sized gliders which had made brief gliding flights, one of them carrying Sir Georges footman (the footman is said to have resigned immediately following his terrifying flight). In more recent times successful hang gliding flights had been made by Lilienthal, the Englishman Percy Pilcher, the Americans Octave Chanute and Augustus Herring and perhaps others. Both Lilenthal and Pilcher had been killed in aircraft crashes.

The problem of lift therefore seemed to have been solved. The Wrights agreed with Cayley that the processes of lift, propulsion and control should be considered separately. This in itself was progressive since with birds the processes are all combined in wings and tail. Furthermore Wilbur thought at that stage that propulsion was the least difficult problem. Most of his contemporaries thought that propulsion was the key to successful flight. Steam and petrol engines by this time were becoming more common and significant reductions in the weight of such devices were being achieved. Wilbur and Orville thought that by the time they were ready they would be able to buy a suitable engine. The major problem therefore was control and the two main components of this were: 1. devising suitable mechanical means to control the flight of the machine and 2. leaning to fly it (similar to the bicycle).

Control by means of weight shift by swinging one's legs about under the glider seemed inadequate particularly given the examples of Lilenthal and Pilcher. Control by means of altering the reaction of the airflow on the wing surfaces seemed to offer more potential. It was known from the work of Lilienthal that a wing approaching the air at a greater angle produced more lift (up to a certain point). Initial sketches suggested various arrangements for pivoting the wings with cogs or levers. A far simpler and more elegant solution occurred however when Wilbur was playing with a cardboard box, previously containing an inner tube. Wilbur noticed that twisting the box warped the surfaces but without bending or loss of strength in the long (span wise) direction. The analogy of the cardboard box and biplane wings of the Chanute/Herring type was obvious. The first glider was built within weeks and by June or July of 1899 Wilbur was flying a box kite of 5 feet span with a forward (canard) stabilizing surface. Wing twisting (warping) was controlled by four tether lines attached to two handles. The wing warping system proved to have a powerful effect on the flight of the kite, the flight being easily controlled. The concept of tilting (roll) the glider/kite to turn is also evident. The concept is similar on a bicycle, i.e. lean to one side to turn in the same direction. Although this idea is readily seen in the flight of birds it was by no means understood by all of the experimenters of the time.

Merry Christmas & Happy New Year!!

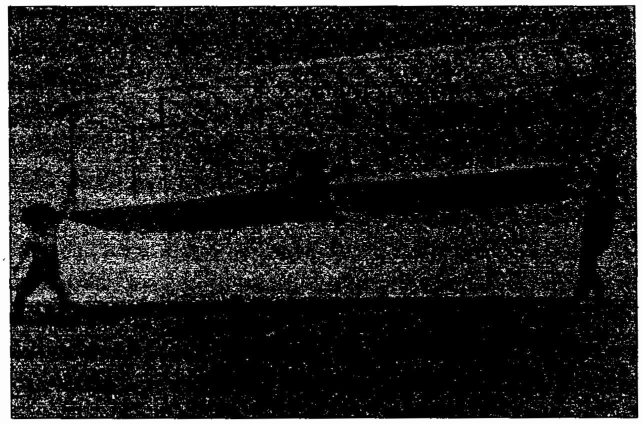


The other major factor in the Wright Brothers success was their process of progressive development in their kite and glider designs. The relatively simple and cheap kite was followed by three full sized glider designs and finally an engine driven aircraft. Each new machine introduced a new feature but previous successful technology was retained. This process is readily apparent when comparing each successive glider with the one before. The process is logical and disciplined. Thus when new aerodynamic problems were discovered the fix was normally achieved by modification of the existing design while retaining the successful features of the earlier design. Progress was measured and advanced by systematic testing, not only of the full sized machines but also small scale wings and aerofoils in a wind tunnel that they built themselves.

Following the success of the 1899 kite the brothers felt ready to build a full sized man carrying glider. The glider was basically a scaled up version of the kite with a span of 17 feet and a chord of 5 feet, wing area 165 sq ft, weight 55 lbs. It was felt that the area around Dayton was unsuitable to practice flying this glider and the US weather bureau was consulted. The brothers wanted a site with regular steady fairly strong winds and open terrain free from turbulence producing trees or hills. A number of sites were suggested including the coast of Baja California but the weather coast of the Eastern seaboard at Kitty Hawk, North Carolina was selected, partly because it was easier to get to from Dayton. A letter to the post master at Kitty Hawk was also warmly received, the post master offering to assist the brothers in any way he could and assuring them of a friendly welcome from the few locals.

The weather is suitable in autumn with steady winds off the sea at 15-25 miles/hour. The brothers stayed at Kitty hawk during September and October 1900. The glider was transported to Kitty Hawk in a crate along with tent and camping equipment and provisions and was assembled at the site. Once again the glider was flown mainly as a kite while the control system and lifting capacity was tested and measured. The brothers had hoped to log a lot of flying time but in the end only Wilbur made free glides logging two minutes flying time during a dozen flights of 10-20 seconds duration. The main success of this year was that the glider was structurally sound and was easily repaired if damaged. The forward elevator was found to control the pitch of the glider and had the desirable property of a vertical parachute like descent in a stall resulting in a heavy but relatively safe type of crash rather than the nose dive type response which had killed Lilienthal. The forward elevator was retained on all the future Wright designs until 1910. On the other hand the lift turned out to rather less than expected which was an unwelcome result.

The following year the brothers Returned to Kitty Hawk in July 1901 with a new glider, somewhat larger, span 22ft, chord 7 ft, wing area 290 ft, weight 98lbs. The structure was the same as before, trussed biplane wing with a single movable elevator in front. This year they built a wooden hanger 16 by 25 ft to store the glider before assembling and flying it. Immediately there were problems. The lifting capacity of the new glider seemed no better than the one before and the elevator response was not nearly as good. They experimented with altering the wing camber trussing the ribs down to flatten the curvature. This cured the elevator response. The lack of lift was not affected but they were able to make some successful glides. The time had come to make deliberate turns using wing warping. At the very first go this caused an unexpected result. An initial bank to the left began normally but then the glider reversed direction on its own swinging to the right. Further attempts produced the same result. At the time the brothers had no idea of the cause of this behavior. They left Kitty Hawk feeling very discouraged.



Once back home however their enthusiasm returned. They built a wind tunnel and derived lift and drag data for several hundred airfoil sections and wing shapes. As a result they found the Lilienthal lift data to be about 40% too high. Wind tunnel experiments continued through to Dec 1901. By this time it was time to stop mainly because they were running out of time to design and construct the new glider in time for the 1902. The new glider incorporated a number of improvements. The span was increased to 32ft and the chord reduced to 5 ft. The wing area was only slightly increased to 295 sq ft but the aspect ratio was much greater, the result of the wind tunnel experiments. The wing section was altered with a shallow camber but the lifting capacity was improved with the new section and the drag was low. In the kiting experiments the glider would soar on a 7 degree slope. The wing warping control system was modified from a foot pedal system to a sliding cradle on which the pilot rested hips. Sideways movements of the pelvis with the pilot lying prone controlled the roll. Most important the new glider had a fixed vertical tail to control the adverse yaw. This worked some of the time but in some instances seemed to cause a stall and wing drop. The surface was made moveable with and linked to the wing warping mechanism as a coupled aileron/rudder. This had the desired effect and the glider was now fully controllable. This glider marked the invention of the aeroplane (as we now know it) with the exception of the engine. It was fully controllable in flight and the brothers made 700 glides between them of up to 600 ft distance. It is in some ways a bit surprising that they did not discover soaring flight during this period as a launch from a high hill into an adequate wind would have had the glider hovering and gradually gaining height.

With the success of the 1902 glider the brothers thought they had the aerodynamic, structural and control problems solved. They were now ready to add the engine and design the powered aircraft. Their wind tunnel data indicated that they would need a minimum of 8 horsepower from an engine weighing 200 pounds or less. The also had to design a suitable drive train and propeller. They wrote to a number of engine manufacturers but the very few engines which met their requirements were considered to be too expensive so they built their own. This is said to have been "a four cylinder inline water cooled engine with no fuel pump, carburetor or spark plugs" ?? " fuel being gravity fed to a small combustion chamber beside the cylinders where it was mixed with the incoming air" ?(sic). The engine was unsophisticated even by the standards of the day but it produced 12 horsepower when warmed up and met the weight requirement. The brothers had also to design a propeller. They reasoned that a propeller is a rotating wing and produced a 6 ft propeller with appropriate twist toward the tips with an amazing 88% propulsion efficiency.

By September 1903 they were ready. The Wright flyer as it is now known had a span of 40ft 4in, chord 6ft 8in with a double vertical fin behind and a double elevator in front. Two contra rotating 6 ft pusher propellers were driven from a single engine beside the pilot with bicycle chain drive. The weight was 750 lbs with pilot. The craft was launched from a wooden track 60ft long. The glider was carried on a small wheeled dolly and landed on its skids.

They returned to Kitty Hawk and spent three months assembling and testing their aircraft. They had a lot of problems. The weather was bad. Misfiring of the engine continually loosened the sprocket nuts (finally solved by applying cycle cement to the nuts). On December 14 all seemed ready. The brothers tossed a coin for the honour of the first flight. Wilbur won the toss and the flyer trundled down its launching rail. After 40 ft it abruptly lurched into the air, stalled and crashed back into the sand damaging the left wing. Wilbur was unscathed.

The brothers did not consider this first erratic hop a true flight. It had lasted less than 3 seconds and Wilbur had found the elevator very sensitive causing him to over control it. However they were now very confident. The systems had all worked successfully and the engine was producing adequate power. Repairs were completed and they were ready again on 17 December 1903. This time it was Orville's turn. Once again the flyer was airborne in 40ft and Orville had trouble controlling the sensitive elevator. The flyer had a tendency to dart up and down. After 12 seconds and 129 ft the flyer hit the ground with a thud but was undamaged. The Wrights had three more flights that day, the last and longest of 59 seconds and covering 852 feet against a 22 mile/hour wind. The elevator was overly sensitive and control was difficult on all the flights. On the last flight the elevator was damaged on landing. Whilst they were considering the last flight the flyer was overturned by a gust of wind and was damaged beyond what they could repair locally. There was no more flying in 1903. None the less history had been made.

The years 1904 and early 1905 were taken up with building a new flyer. The Wrights did not return to Kitty Hawk , except for Orville who took a new glider back in 1911. This time he did learn to slope soar and set a record of over 9 minutes which lasted for ten years. Hence forth flying was conducted at Dayton Ohio at a nearby open space known as Hufffman's Prairie. The Wrights spent the next three years practicing their flying skills and improving their machine. They stopped communicating with other aviators as they sought patents on their inventions and began to try to interest first the US Government then foreign Governments in buying their invention.

Despite the fact that there were many witnesses to their flights the world was frankly skeptical. All the mistrust the Wrights might have had for the public beyond their family was proved to be fully justified. By 1906 some other experimenters were beginning to have some success at make short hops in their machines. The French aviators in particular were horrified that the honour of making the first flight might go to Americans and tried hard to discredit the Wright claims while encouraging French efforts to claim the prize which on burst of Gallic National Pride they thought was rightfully theirs. Gabriel Voisin was particularly vitriolic against the Wright claims, supported by Louis Bleriot and Henri Farman. To his credit he did later retract his earlier outburst and admit that the Wright claims were fully justified. Governments prevaricated and did not want to enter into agreements without first having the flyer demonstrated and examined by experts. The Wrights of course were reluctant to agree to this because their ideas, although clever and well advanced compared to others at the time were not difficult to understand or copy once they had been demonstrated.

In 1908 the US patents had been issued and foreign patents also approved. The Wrights thought they had a deal with the French Army and agreed to demonstrate their machine. The appearance of the Flyer at European public venues caused a sensation. Huge crowds attended the flying fields to watch and they had visits fro royalty of many European countries. The Wrights were showered with awards, medals and testimonials. They returned home to the USA as National Heroes and received more medals and awards. Both of the Brothers did a lot of flying in 1908 and 1909 and they set record after record for speed, distance flown, duration carrying passengers etc.

In the mean time almost every aviator in the world copied their ideas regardless of their patents. They became embroiled in patent litigation which went on for years. Glen Curtiss in the States was particularly troublesome, blatantly ignoring the patents, competing with the Wrights in his machine at every possibly public display and using every possible delay and appeal in the courts to escape the consequences.

Wilbur especially tried very hard to make a commercial success of their invention and they did indeed make some money but the effort was tiring and distracting. In 1911 he became sick and died in after a short illness. Orville sold the business soon after, when the patent litigation seemed to be going favorably. He did quite well and was able to build a mansion in Dayton where he lived for the rest of his life. He did not much enjoy business but he was determined to defend the Wright's record and historical claims to the end.

The record of the Smithsonian was fairly shameful. Samuel P Langley, a self trained astronomer was the secretary of the Smithsonian Museum in 1903. He had persuaded the US Army to support his experimental flying machine, the Langley Aerodrome with a grant of $50,000. The Langley Aerodrome was launched from the top of a houseboat on the Potomac River, Washington on 8 Dec 1903, just weeks before the Wrights successful first flight. The Aerodrome wings folded up as it left the launching ramp and it plunged into the river. Nor only did the failure of the Aerodrome discourage the Army from investing any more money in flying machines, particularly in the Wrights direction, but the new director of the Smithsonian, Charles Abbott hoping to redeem the honor of his old friend promoted the achievement with a Langley prize in Aeronautics, Langley laboratory and a plaque of commemoration. The Wrights were outraged that no similar honor was afforded to them.

But worse was to follow. Glen Curtiss was finally cornered in the patent litigation and it looked as though he would finally have to stop flying in the US or be bankrupted. Curtiss approached the Smithsonian with an offer to rebuild the wreck, of the Aerodrome and demonstrate that it 'was capable of flight in its 1903 form'. This would invalidate the Wright patent since Langley would have demonstrated a successful technology prior to the Wright claim. Incredibly the Smithsonian agreed. The Aerodrome was rebuilt incorporating numerous structural and other improvements including Wright technology and subsequently flown from a lake in 1914. Orville Wright demanded that the Smithsonian put the record straight and admit that the Aerodrome of 1914 was a very modified aircraft from that of 1903. He received no reply.

Finally realizing the power of the Flyer as a National Symbol, Orville decided to donate the Flyer to a foreign museum. The Flyer had been totally neglected since the accident at Kitty Hawk in 1903 and was little more than a tangle of wire and sticks but it still existed although it had been moved several times and some parts had been lost. Orville had the Flyer rebuilt replacing the damaged or lost parts and donated it to the Science Museum in London. This time the American public were outraged and deluged the Smithsonian with complaints. Charles Lindberg was called in to negotiate a truce but found both sides intransigent although he said he agreed with Orville.

The Flyer was crated up and sent to London. He did however include a note saying that if he sent a letter before his death repealing the gift the Flyer should be returned to the USA. The Flyer would have stayed in London for ever except for the intervention of an author, Fred Kelly who was working on a biography of the Wright Brothers. Kelly was concerned that Orville would not approve his manuscript and hoping to put Orville in his debt persuaded Charles Abbott, the Director of the Smithsonian to publish an article in 1942 setting matters straight. Abbott finally agreed and a statement was published but there was no reply from Orville.

Orville died in 1948. The executors found a letter in his files indicating that he had in fact found the Smithsonian letter of retraction acceptable and the Smithsonian subsequently asked the Science Museum in London if the Flyer could be returned. The Science Museum graciously agreed requesting however that they be given time to prepare detailed drawings and a replica of the famous aircraft. They had in fact taken very good care of the Flyer, carefully crating it up during the Munich crisis and storing it firstly in the Museum basement, and then, when that seemed unsafe during the blitz in a quarry in Wiltshire west if London. Thus it was that the Flyer, after a suitable replica had been made was crated up again in November 1948 and shipped to New York aboard the Liner Mauritania.

The Mauritania however was diverted to Halifax, Nova Scotia because of a longshoreman's strike in New York City. Paul Garber, the Smithsonian aeronautical expert rushed to Halifax to accept delivery. Garber, formally a lieutenant commander in the US Navy during WWII had arranged for the Flyer to be transported in a Navy Truck from the New York docks to Washington. Now he placed a call to Admiral Pride with an additional request. Several days later the aircraft carrier USS Palau docked at Halifax, loaded the Flyer and delivered it to the New York Navy Shipyard, where an honour guard stood watch as the Flyer was loaded on a Navy truck for delivery to Washington. The Flyer is displayed now in the pride of place suspended above the entrance of the Smithsonian National Air and Space Museum, Charles Lindberg's 'Spirit of St Louis' having been moved back to make room.

I had expected when I bought this book that it would contain everything I wanted to know about the Wright Brothers and their aircraft and development. I am partially satisfied. It does have everything I wanted to know about the Wright Brothers but it is rather lacking about the aircraft and their development. In compiling this narrative I have had to draw on other sources for some details about the Flyer and the gliders. Wilbur and Orville made numerous and detailed notes about measurements and flight testing which are mentioned only in passing. The analysis of the wind tunnel tests and the Brothers interpretation of the results are apparently a bit obscure but are glossed over in this account. The Brothers apparently found that the well known Smeaton coefficient had been overestimated. I have never heard of the Smeaton coefficient and I am none the wiser after reading this book. The description of the Wright Brothers engine which I quoted above also makes me doubt the technical capacity of the authors.

The photographs however make up for some of the failures of the text and I am reasonably happy for the purchase price of $69.95.

LAUNCHING GLIDERS. PART 2

By Peter L. Champness

The article on launching gliders in the last newsletter attracted quite a bit of comment, mostly positive. My favorite idea is car towing with a turn around pulley. Ian Patching says that he has seen this done at Bacchus Marsh. Two cars were used and 9 gliders were launched in as many minutes.

Andre Mertens has sent a letter with some valuable information about the use of Subaru Engines which may be a better alternative to a Chevrolet or Holden V8 and James Garay has given me a set of drawings for an Evans VP2 on a CD disc. The VP2 has a very simple appearance with straight, constant chord flying surfaces and a square section fuselage. It was designed as either a two seater, side by side for small people, or a single larger person sitting in the middle of the seat. It uses a Volkswagen engine. I feel it might be a bit small for a glider tug, especially if a larger engine is to be used. It would be helpful if the aircraft was big enough to take two big people and still tow a glider so that new tug pilots could be instructed in the art of towing. I also think the ideal glider tug would be made of metal for a more robust structure which can be left out in the rain if necessary.

The idea of a simplified airframe however could be considered and the VP2 shape is a good start. It can still be a fun aircraft to fly, with good towing performance if a suitable engine is installed. I have been trying to consider how many simplifications can be achieved with subsequent reduction in building time and cost. For instance if all the ribs are made the same it would be possible to make a single former and then press all the ribs with a rubber press in less than an hour. The fin and tail plane can be made the same like the Pilatus Porter. It might also be possible to make the rudder, elevators, ailerons and flaps all the same. Then they could have a single rib shape and spars formed from sheet metal with a sheet metal bending brake. Wing spars folded from sheet steel would have good fatigue resistance. The airframe could be assembled with pop rivets. The small bumps on the surface are not likely to affect performance significantly at the speeds envisaged.

It is evident from the VP2 drawings that there are still a lot of small parts and fittings which take a long time to make. There are a lot of items like hinges, rudder pedals, petrol tanks and fittings, bell cranks and control columns which are similar between aircraft but different in small ways. As far as possible off the shelf items should be used, perhaps purchased from a firm like Gippsland Aeronautics.

For those who were wondering about the economic considerations in the previous article which seem a bit odd these days, the article was actually written quite a few years ago. In those days it was actually possible to invest money at an interest rate of 10% , as unusual as it might seem now. James ran out of items and needed an extra article to complete the newsletter.

Since the article was written I have thought of two new ways of getting a glider off the ground. The first of these was suggested by John Lynch of Tocumwal. He considered fitting two large model aircraft engines to his Marske Pioneer. At the time the German firm 3W Motoren made a large 2 cylinder engine producing about 4 horsepower. Eight horsepower is probably not quite enough even for a small glider. Since then Saito and O.S.Engines have been making 4 cylinder horizontally opposed engines and 5 cylinder radials for large scale model enthusiasts. They are not cheap however and two are probably required. They also do not have self starting capability so restarts in the air are not possible. O S makes a large single cylinder engine of 20 cc with a power of 3.7 horses at 9000 rpm. Six of these mounted on a beam should give sufficient power to launch a light single seat glider.

The second idea is similar and results from the development in recent years of jet engines for model aircraft. As the jet engines have become better and more reliable they have also become more powerful. The most powerful version I have seen advertised claims 50 lbs thrust. Two such engines (100lbs thrust) should launch a single seater. The Mike Burns two seater Caproni jet powered glider uses a Microturbo jet and has about 195 lbs thrust which apparently gives it good performance.

Two innovations have made the model jet engine suitable for our purposes apart from the increased power. The first is the use of microprocessor control of the speed and combustion process. This overcomes many of the problems of compressor surge and flame outs and compressor stalls which are apparently common with jet engines. The simple centrifugal compressor designs which were typical of the early British jet engines are also fairly resistant to these problems. Improved turbine wheels made of high temperature inconel alloy have allowed considerable increases in the power.

The second innovation is in the starting process. At first the engines were started by blowing compressed air from a cylinder through the engine to get it going. A fire extinguisher was an essential accessory because spilt fuel fires were so common. A few years ago I watched Brian Green, a local model jet enthusiast demonstrate his homebuilt engine. He started his engine by spinning the compressor shaft by hand to get a small amount of airflow through the engine, the turning on the fuel and igniting it with a spark plug in the combustion chamber. A soft 'poof' sound was heard indicating ignition. The engine was still not running however because a jet does not produce enough power to sustain its own momentum until a minimum idling speed is achieved. For model jet engines that is about 15,000 rpm. Brian then had a small electric motor with a rubber plug on the end against the end of the jet engine compressor shaft and accelerated the engine up to self sustaining speed. The latest designs of model jet engines have an electric motor already built into the front of the engine. Self starting is hence possible and the whole process is controlled by the microprocessor.

One interesting fact about jet engines is that a powerful fuel pump is required to get fuel into the combustion chamber. Once the engine is running the compressor is forcing air into the combustion chamber at high pressure (about 2-3 atmospheres for a centrifugal compressor and much higher for modern axial flow full sized engines). Hence the fuel cannot get into the combustion chamber unless it is pumped in under even greater pressure. If the engine stops for some reason such as bearing failure etc the fuel is still being supplied at high pressure and a fire results unless the fuel is somehow cut off promptly.

Model, jet engines are not cheap. Present prices are about $5,000 each. If two are required that means $10,000 just for two engines. The price is still quite good however compared with a new aero engine, which start at about $20,000. The benefit is that they are very small and light which minimizes installation problems. The fuel consumption is very high so a quick launch is all that can be expected, not sustained cruising.

Just as I was thinking about all this I read the latest issue of 'Soaring'. A New Zealand group is developing a jet powered unit for Hang Gliders. Their engine apparently produces 95 lbs thrust which would be suitable for a single seat glider. I shall be awaiting further developments with great interest.

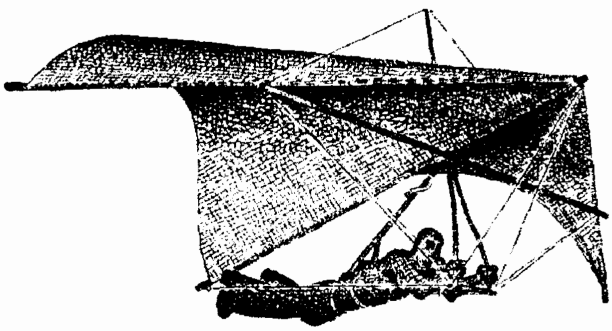
The Eagle flexible wing hang-glider

Sergio Montes, Kingston Beach, Tasmania

Introduction: *Having been asked by the editor to contribute to the AHSA newsletter, I find that a subject that overlaps conveniently our areas of interest is that of ultra-light gliders, sometimes called hang-gliders, which share some of the problems of model planes, on whose design and flying I report in the pages of Free Flight Quarterly. In this common area, the choice of airfoils is of the greatest importance and little of the modern technology that has produced spectacular results in rigid wing, high speed (and consequently high Reynolds number)s gliders is applicable to model aerodynamics. Thus when confronted with developments such as those described in what follows, one cannot be but grateful for the remarkable insights brought by what may be termed "lateral thinking" in the part of glider designers.*

Background of the Eagle hang-glider

Current flexible wing aircraft have been developed over the last 25 years or so from the Rogallo Sailwing (fig 1). The enduring original attraction of the Rogallo was that it provided all the basic requirements of a glider in something simple that could be stored at home, rigged, carried, launched and flown all by the pilot himself. This development of the Rogallo delta-wing glider was due to Michael A. Markowski of Marlboro, Mass., an aerospace engineer who had participated in the design of the Douglas Aircraft Company's DC-8 and subsequently did research for Sikorsky Aircraft. Markowski substituted an airframe of tubular aluminum for some of the tension lines of the Rogallo kite and fitted the structure with a control bar of aluminum tubing in the form of an inverted Y. A harness suspended the pilot in either a sitting or a prone position, from which he could grasp the control bar and exert force against it, thus shifting his weight to control the craft in pitch, roll and yaw.



The modified ROGALLO hang-glider

Markowski describes the evolution of his project:
"My interest in foot-launched gliders began as a spare-time activity, strictly for fun. After designing several rigid-wing biplanes and a monoplane of the flying-wing type I settled on the Rogallo wing as the most practical means of acquiring experience in the art of hang gliding. By taking advantage of several technical reports about the Rogallo wing that had been compiled by NASA I designed a full-scale model that by good fortune flew 'right off the drawing board.'

"My first hang glider had a sail consisting of .004-inch (0.1 mm) polyethylene. The machine weighed 40 pounds empty (about 14 Kg). It served me well for many ground-skimming flights until the sail began stretch-[ng, which degraded the glide ratio. As the temperature dropped during the fall of 1971 the plastic started to crack. After consulting a parachute rigger, who was familiar with sail materials, I replaced the polyethylene with rip-stop nylon. This material served for about a year before I retired it. Nylon is too elastic to maintain the curve of a good sail. I now use Dacron sailcloth".
That prototype glider turned out to be only the first of a series of models. It was followed by both radio-controlled and free-flight models at reduced scale for investigating still other characteristics of the Rogallo wing. Fortunately this series of experiments alerted me to startling fact. In the jargon of aerodynamics Rogallo kites are 'pitch-down divergent.' When the nose is lowered, the craft speeds up and the sail begins to fluff, or flutter, at the trailing edge. The flutter advances toward the apex and the craft dives at an ever increasing angle until it strikes the ground!

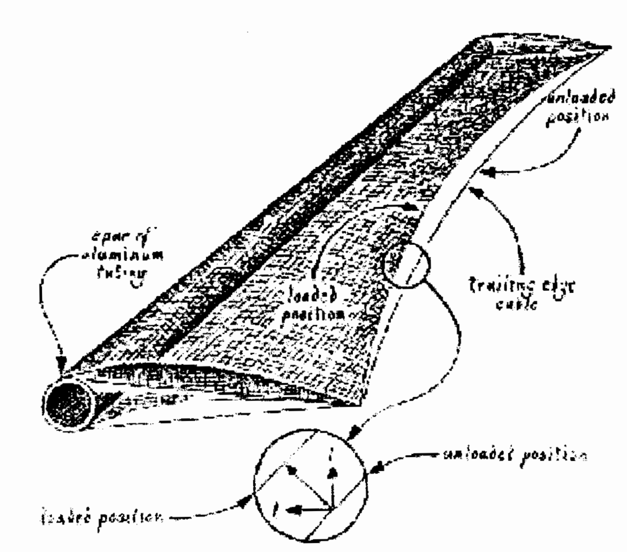
"Having observed this disconcerting behaviour in the small models, I decided to learn by experiment if the phenomenon would also occur in a full-scale glider. It did. The initial solution that came to mind was the addition of a horizontal stabilizer. I tried one. It worked, but it was awkward and was easily damaged in normal use. The final solution was simply suspending a weight some distance below the keel of the glider. This device worked well and introduced no structural problem.

"Sky surfing is an art. It can be mastered only by diligent practice. Of necessity the hang-glider pilot must be self-taught. The craft do not have dual controls for instruction, as conventional air-planes and gliders do. You start by learning a few additional details about your physical prowess and the reaction of the kite to the wind on level ground before you venture even briefly into the air. Like all young birds, you try your wings many times before leaving the 'nest.

It is somehow considered that the Rogallo kite is an exceptionally safe craft. In actuality it is only relatively safe. Aerodynamically the wing is characterized by a very gentle stall, meaning that when the kite begins to lose flying speed, it tends to settle rapidly and to nose down slowly instead of going abruptly into a nose-dive. Its performance is governed by the same laws of physics that affect other flying machines.

The Rogallo kite is basically easier to fly than other aircraft because the pilot controls it by shifting his weight, which is a more or less instinctive action. How-ever, weight shifting as a control technique has its limitations. The forces of the controlling moments remain constant, whereas the disturbing forces are squared with speed. Aerodynamic controls of the kind developed by the Wright Brothers enable one to fly safely in winds that would be unsafe for a hang glider of the Rogallo type. In other words, the Rogallo wing is no toy, and it can be a killer. For example, most beginners do not know how to land one safely from a stall at a height of, say, 40 feet. This manoeuvre can and must be learned by patient practice.

Ultra light hang-gliders are lightly loaded aeroplanes and initial flight tests must be done in calm conditions. These aircraft differ in the ease of changing the aerodynamics during development, and in the complexity of interacting effects, compared to conventional three axis control aeroplanes. Both wing loading and airspeed important factors in the design of all aircraft. With these constraints in mind Markowski designed a series of gliders based on the Rogallo wing for pilots weighing from 100 to 210 pounds. The gliders could be flown in wind speeds ranging from less than seven miles per hour to more than 20 miles per hour. In general the resulting craft have a maximum glide ratio of about 4.5: 1 and a minimum sink rate of 450 feet per minute. Although one can have a lot of fun with a glider of this performance, the duration of flights is necessarily limited to minutes rather than hours. Sky surfing (with a Rogallo wing) is comparable in this respect to surfing at the beach, a succession of one-way trips. He wanted a craft of higher performance that would enable him to glide continuously along windward slopes in both directions by making 180-degree turns at the ends, a performance to be obtained with a minimum of fuss. That meant developing a machine that one person could not only assemble and disassemble but also fold and load for transportation atop an automobile.

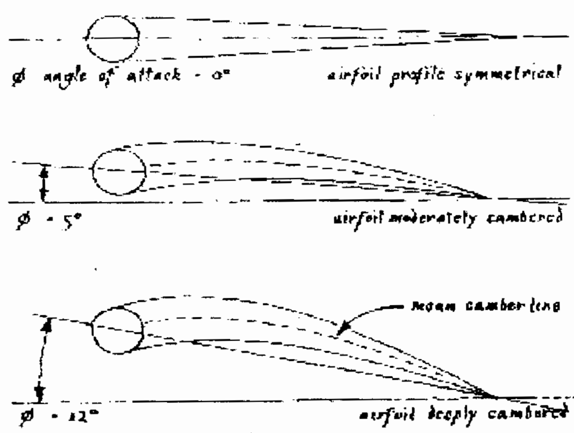


The Princeton sail-wing

An invention that promised to make possible such a glider came to his mind when he recalled a University course in low-speed aerodynamics. During that course a "sail wing" that had been developed at Princeton University in 1948 was described. The device had been developed as an advanced sail for boats. In 1952 it had been adapted for possible operation as an auxiliary lifting surface on ground-effect machines. Basically the sail wing consists of a tubular spar that supports the leading edge of a fabric envelope and a set of short, rigid booms at the tip and foot of the spar between which a slender cable is stretched to form the trailing edge of the wing [see Fig. 2 above]. The structure can be easily folded and stowed.

Aerodynamics of the sailwing

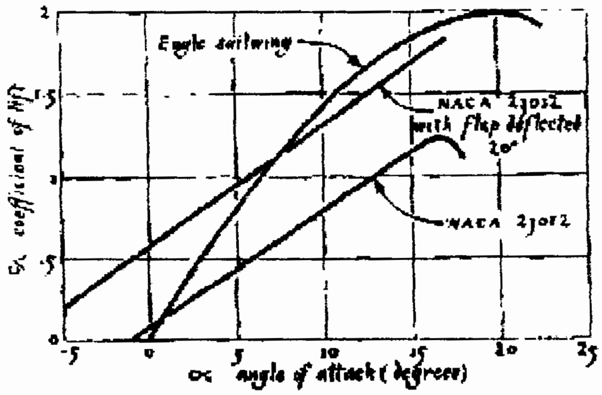
The aerodynamics of the sail wing are both simple and impressive. The performance approaches that of conventional ribbed airfoils in terms of lift and drag. At zero angle of attack, when the plane of the wing lies in the plane of its motion,



Response of sail wing to angle of attack

the sail wing assumes a symmetrical cross section that generates no lift [see Fig. 3 above). At an increased angle of attack the surfaces of the wing form a cambered airfoil that does develop lift. Moreover, the camber deepens with increasing angles of attack, an aerodynamic effect equivalent to the effect of an automatic wing flap.

A graph that depicts the wing's resulting force of lift slopes upward more steeply than that of a conventional 'hard' wing [see illustration below].



Aerodynamic characteristics of various airfoils

An important factor determining the glide ratio of an aircraft is the relation between the span of the wing and its mean chord, a relation termed the aspect ratio, AR. It would be incorrect to state that doubling the aspect ratio of a wing would double the glide ratio of the aircraft, but increasing the aspect ratio greatly improves the glide ratio. The glide ratio is numerically equal to the lift-to-drag ratio. The drag of the airfoil is the sum of the **profile drag** caused by surface resistance, and the **induced drag**, a resistance due to lift. As is well known, the coefficient of induced drag is equal to:

$$\mathrm{CD(induced)} = \mathrm{CD_i} = \frac{\mathrm{CL}^2}{\pi \mathrm{AR}}$$

In which CD_i is the coefficient of drag, CL is the coefficient of lift and AR is the aspect ratio

Markowski reviewed the tabulated aerodynamic characteristics of several hundred airfoils and came to the following conclusions:

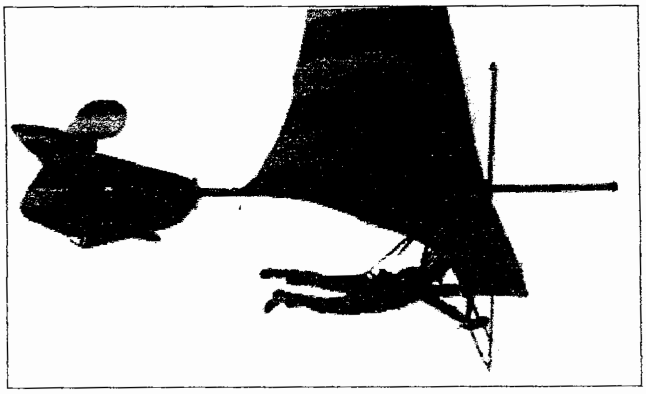
- In a low-speed airfoil the coefficient of lift should increase at the rate of about 7.5 percent of the angle of attack;
- Stalling conditions should become evident at a lift coefficient of about 1.6;

- the larger the diameter of the leading edge the gentler the stall and the higher the coefficient of lift;
- the deeper the camber the higher the coefficient of lift, and that the high point of the camber should be more than one third of the distance from the leading edge of the airfoil to the trailing edge, this last conclusion in good agreement with the basic airfoil theory.

It was observed with surprise that these characteristics agreed well with the results of experimental tests made on the sail wing, as reported by Princeton and by NASA. It was clear that the sail wing combined high performance in a simple, foldable structure.

This favourable coincidence induced him to proceed and he promptly built and flew a series of scale models, some of which were radio controlled. The first prototype, which was named EAGLE-I, had a wingspan of 40 feet and weighed 70 pounds. The wing lay in a single plane, that is, it had no upswept dihedral angle. The aspect ratio was 8:1, the area was 200 square feet and there was no sweepback. The tail had a conventional rudder, an elevator and a horizontal stabilizer. For lateral control ailerons were substituted by spoilers. The spoilers were small flaps that could be lifted by control cables to create drag near either tip of the wing.

Initial ground and `sail inflation' tests were made by the same procedure that applies in learning to fly a Rogallo wing. When the machine was lifted into the slightest breeze, the sail wing assumed exactly the predicted contour. Flight testing was begun on low, shallow sand dunes. The first few ground skims indicated that the elevator gave perfect control of pitch; they also helped to find the proper balance point by shifting the suspension harness. The rudder proved to be of some value in controlling yaw, but the spoilers were ineffective. The fabric of yaw control surfaces became grossly distorted under load, which necessitated redesign.



On the other hand, EAGLE-I was fully stable in flight and had a glide ratio of close to 10:1, Although the spoilers were enlarged 50 percent, the modification was never tested. A critical inspection of the craft indicated that a number of design simplifications could be made in the construction of the airframe. Moreover, it was decided to achieve lateral control by the Wright Brothers' system of wing warping. The result was a much cleaner design that weighed 63 pounds. Flight tests proved that the machine was a high-performance glider. Markowski relates that:
"...I took the step in a breeze of 10 miles per hour, pulled back the control stick and was lifted almost straight up. It was a fantastic sensation."

The lateral control system, however, was still ineffective. Moreover, it was apparent that the span and area of the wing were much too large to handle well in anything more than a flat calm.

Development of the Eagle design

The additional tests and modifications led to the construction of EAGLE-II. This machine weighed 75 pounds and had a wingspan of 34 feet and a wing area of 158 square feet. The removal of few bolts made it possible to fold the craft easily for transportation on a car. EAGLE-II had a set of pulleys and control cables and a control stick that enabled the average hang-glider pilot to make an easy transition to the high-performance craft. The wing, with an aspect ratio of 7.25: 1, was non-swept. On test it developed a lift coefficient in excess of two, with a gentle stall. Indeed, the "stall" would be more aptly described as a "mush", that is, a parachute-like settling rather than a dive. When the control stick was pulled backward slowly, the angle of attack and the camber of the wing increased simultaneously. The action was followed by a steep but slow descent, somewhat similar, for those that have seen this, to the descent of a dethermalized model glider. Response to the controls remained good up to stall but was sluggish in yaw in the "mush" condition, as could be expected.

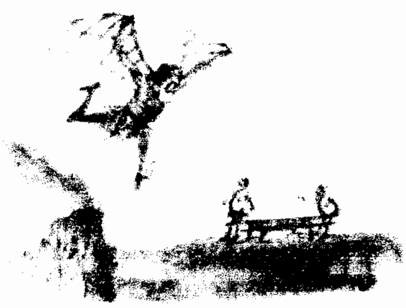
EAGLE-II had a wing taper of 3:1 and a dihedral angle of eight degrees. At first the craft was rigged for a dihedral angle of only two degrees, but it tended to skid too much in yaw. Two degrees of washout were added in the tips of the wings to guard against tip stall. (The tips of the wings are twisted to reduce the angle by two degrees.) The structure was stressed by a test load equivalent to six times the force of gravity with a safety factor of 1.5.

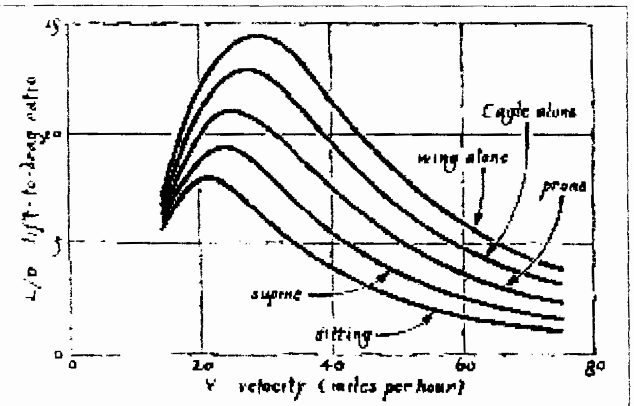
The tail structure consisted of a frame of aluminium tubing that supported fabric of rip-stop nylon. In time it became apparent that this material stretched excessively. The resulting exaggerated camber degraded the glide ratio. As was mentioned before, the nylon was replaced with stabilized Dacron sailcloth.

Both the rudder and the elevator were balanced aerodynamically, that is, they were hinged slightly forward of the quarter-chord line of the control surface. The horizontal stabilizer and the elevator were removable as a unit from the keel of the airframe.

The side area of the rudder and the amount of dihedral used were well coordinated and combined to produce a roll-yaw couple that helped make turns easy. Hinged structures of covered aluminium tubing that formed the wing tips both warped the wings and served as ailerons. Consequently they were named "warperons".' Coupled directly to the rudder, they deflected the wing tips differentially just enough to produce coordinated turns.

Cartoon by Andre Paul Terret

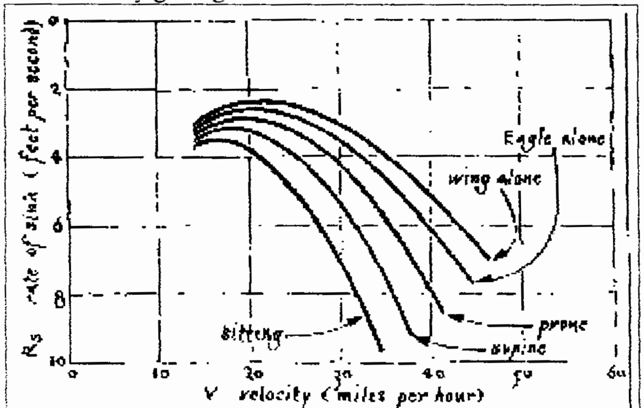




Eagle II Lift to drag ratio at various configurations and flight velocities

Eagle -III

The next step in the development was Eagle-III, for which exhaustive flight tests were carried out. In theory the maximum glide ratio of the machine alone is substantially better than 10:1. This performance is of course degraded by the presence of the pilot, who creates forces of drag but no lift. The amount of drag introduced by the pilot depends on his position. Computations indicate that when the pilot flies in the prone position, the glide ratio of EAGLE-III approaches 11:1. In the sitting position it is almost 8:1, (see Fig. below) These figures assume an optimum airspeed of about 24 miles per hour. The sink rate also varies with the amount of drag induced by the pilot; it is about 200 feet per minute. The performance of EAGLE-III is therefore compatible not only with sustained flight on the windward side of sloping beaches and comparable terrain but also with cross-country gliding.



Sink ratio of Eagle III

Essentially EAGLE-III is an ultralight, high-performance monoplane with a variable-camber wing. It is possible for the pilot to stall the craft in flight, but the stall is gentle compared to that of a standard airfoil, such as the NACA 23012. It is not really a beginner's glider, but pilots who have mastered hang gliding with a Rogallo kite make an easy transition to this high-performance craft.

Differences with the Rogallo type-hangglider:

As mentioned before, the flight experience needed to fly the Eagle Sailwing is essentially due to the fact that the roll control system in the Rogallo hang-glider is not the same as that of conventional ailerons (or warperons), where the control surfaces apply the rolling moment aerodynamically. Instead, the rolling moment is physically applied by the pilot as a torque to the airframe in the roll axis, and the wing deflects asymmetrically to aid the response. For example, the pilot wishes to turn right:

1. He applies a rolling moment to the right by pushing the control bar to the left.
2. The loading on the right wing increases, and the washout increases.
3. The washout in the right wing reduces the increase in the angle of attack as the right wing drops, so making the roll response faster than with a rigid wing.
4. The loading on the left wing reduces and so does the washout.
5. The aircraft rolls into the desired bank. The pilot removes the input and coordinates the turn with pitch as the wing approaches the desired angle.

It can be appreciated that the slacker the wing, the more responsive it is in roll. It is also generally the case that the performance will be worse too, due to excessive washout. There is always a drive, therefore, to maximise performance without sacrificing roll response. Competition hang gliders have a variable geometry system, enabling a tighter wing for inter-thermal glides and a slack wing for manoeuvring in thermals or when landing. Various features of the wing have been developed to aid roll response for Rogallo-type hang-gliders, which are not needed in the Eagle system©.

Merry Christmas & Happy New Year!!

Cartoons by Andre Paul Terret on WW-I "AERO" May 2003. With thanks.

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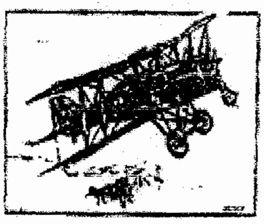

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