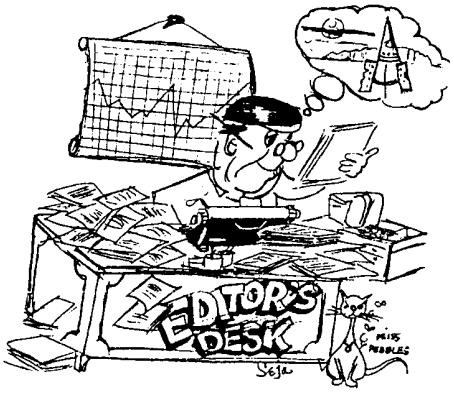
THE AUSTRALIAN HOMEBUILT SAILPLANE ASSOCIATION

Volume 1 Issue 2 **September 1996**



Well time goes quickly and here I am again! Many thanks to all of you for your input into the last issue. Your positive comments and suggestions for the new format of our journal is greatly appreciated.

The suggestions that I've received are all under examination, especially those relating to our logo which appears to be accepted by the majority of our members. Inserting cartoons seems to be a good idea and I will try to insert them where space is available.

The success of this newsletter depends on your input. I have a wonderful support team backing me up around the clock so I can't take all the credit. This is what they do....my daughter Vicky is in charge of the compilation, typing and presentation. My son Eddy covers all technical aspects in computing and programming. A new A.H.S.A member, Sergio Jacobi is in charge of the cartoon drawing department and Peter Raphael does all the printing, mailing and circulation... what a team, thanks for your support!

We are lucky to have with us two technical editors. One of them is Gary Sunderland, well known around the world for his series of articles "Hammer & Soar" published in the Australian Gliding magazine. The other member is Mike Burns who also is well known here in Australia, he used to work with the Gliding Federation of Australia as CTO/A. Both of them are an example for their dedication in promoting homebuilts and gliding just for the fun of it. The rich amount of knowledge in them is always at our service for those interested in solving technical problems related to homebuilt sailplanes, motor gliders and the light weight sailplanes.

Here at the A.H.S.A we are aiming to promote affordable construction of gliders, powered sailplanes and ultralight sailplanes. We are not interested in record breakers, social activities, gossips or mega buck ships. Think about it??

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I was reading "Sailplane Builder" March, 1996 issue and the editor Dan Armstrong was reporting about one incident relating to the building of the "A.S.C Spirit". Here is an excerpt from his article.

I was called over to the soarcraft hangar at Mountain Valley Airport here in Tehachapi last night for a little bad news. Rick Sergeant was assisting Tom Riley perform a wing bending test on Toms "A.S.C Spirit", when the wing failed at about 5g's of load. This is the fourth Spirit or Falcon wing bending failure that I have heard of and I am convinced that the design needs to be carefully reviewed. Tom had done beautiful work and all of the damage occurred in areas that had been done by the factory. There is no excuse for failures in wing bending below limit load. JAR 22 requirements that govern most new sailplanes in the world require 5.3g minimum limit loads at the positive high angle of attack loading situation. A minimum safety factor of 1.5 is required for ultimate loads without failure for at least three seconds. Experimental homebuilt regulations do not require meeting JAR 22 regulations but it only makes sense that the basic structure should be able to carry normal sailplane flight loads without failure. If you own a Falcon or a Spirit, don't fly it until this is resolved. We want you around and we will keep you posted.

Ed's Note : Several American Spirit's are actually under construction in Australia, sold by Advanced Soaring, Australia, 7 Lyon Avenue, Turramura, NSW 2074.

James Garay

All correspondence to:
James Garay
3 Magnolia Avenue
Kings Park, Victoria, 3021,
Australia

Inside This Issue ☞
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MAILBOX

Dear Ed,

Congratulations, you have done a good job with your first edition of the newsletter, it looks really professional.

You asked me to write an article for the newsletter about tips on homebuilding, well after spending a couple of weekends putting pen to paper I found all I'd achieved was confined to the rubbish bin! It's all been done before!

On researching the subject all this information is available from such publications as the G.F.A - Manual of Standard Procedures, E.A.A Publications on Wood, A.G, etc and I feel sure anyone intending to build their own aircraft will have read these.

Most homebuilders have their own ideas anyway, nevertheless, they often seek others opinions or advice but seldom act upon the advice sought.

The best advice I can offer is stick with the designers plans, remember he has given much thought in designing his aircraft. A builder may change some parts only to find this leads to another alteration later on.

To go down this path it adds time to the project in carrying out the modifications which may or may not be approved and will need to be justified to gain type approval, the whole process becomes very frustrating, so stay with the plans which are approved by G.F.A.

Happy sawing and soaring!
Doug Vanstan

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Dear Ed,

It was great to hear you have taken on the job of the newsletter. Enclosed cheque for membership. As you may or may not know I have designed a 15mt self launch sailplane, 4 piece wings and fully retractable motor.

At this stage I have pulled a mould off the plug which has taken all year but now its done and it will be really quick to make the fuselage. The wings mould (skin) is 80% complete and the wings jig is started. I have the motor a 277 "Rotax" but will modify it to approximate a 275 with belt drive. The wing spars are about to be started and will be proof loaded before the wings will be made up. The glider is all glass. It will be called GMO - 104.

Gary Morgan

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Dear Ed,

Thank you for your letter in which you ask for permission to print my article in the "Australian Homebuilt Sailplane Association" newsletter. Permission granted.

With great interest I read through your newsletter and found it very informative. Sorry for responding so late, but at first I thought it was another piece of junkmail and left it on the kitchen table. More so I was pleasantly surprised by the contents.
Having joined three organisations already during my homebuilding experience I find it hard to explain to my finance minister to join another one.

Nevertheless, I will keep it for later (you never know) and try to make it to Gympie in October as I am very interested in all aspects of aircraft building. Hope to see you there.
Happy landings, Lorenz Eckard

Dear Ed,

Congratulations and best wishes for the future of the AHSA.

Please find enclosed a completed application for membership renewal and the fee.

Attached are a couple of items that can be published at your discretion.

I assist a number of people around Australia who are building sailplanes with technical advice, materials, stage inspections, design approval for modifications, weight and balance and other bits and pieces. Most of that work is done at a low charge rate or free of charge. The one thing that all homebuilders need from time to time is assistance in the above areas to ensure that their end product is both well built and safe.

The undersigned has been involved in homebuilding since 1952. During that time span homebuilding has not become a significant part of our sport and I doubt that it ever will. It will of course, always have a small nucleous of people who keep the idea alive and the AHSA can help in that regard.

Since 1952 I have heard the phrases "GFA only looks after the competitive part of the sport" and all the other rhetoric that flows from time to time. Our sport is very diverse, Chris Kennedy in Brisbane is building a BG16, has been for 10 years, total cost?? $10,000. There is a NIMBUS 4 self launcher operating at Tocumwal owned by a Japanese syndicate total cost well over $300,000, that emphasises the diversity of the sport. All we can expect from GFA, (which when you think about it is us), is for that system to provide equal and fair access to its resources.

The prime thing to remember with Australian homebuilding is that the GFA system covers all inspections and certifications with no CAA interference. When your project is completed the sailplane is given a Certificate of Airworthiness the same as the production sailplanes. Even in the US of A they are not that liberal.

The AHSA newsletter goes out to the AHSA members. So we talk to ourselves. To get the other 3500 people interested, the newsletter would have to be the centre 4 pages of the Australian Gliding magazine, then all GFA members would have the opportunity to look at homebuilding and see if it is for them.

My guess is that there would be little or not change in homebuilder numbers.

I consider myself one of the lucky people who have been able to take an aircraft from an idea, through construction, to test flight. That feeling of achievement is a unique life experience.

Happy soaring!
Mike Burns

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Dear Ed,

With reference to the article about John Stockwell's "Woodstock" in June '96 of the A.H.S.A newsletter the removable tailplane modification was designed and approved by me for Ken Davies some years ago.
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It was drawn up before Ken got to that bit and as I have noted in previous newsletter, I really need feedback from builders on any problems so I can correct and update the drawings.

I would appreciate details of John modifications and anyone else using the design, so I can correct the drawings for future builders.

Incidentally all the removable tailplane modification design data was sent to Jim Maupin Inc. in the U.S.A, where the family are still providing drawings and technical back-up to Jim's designs.

I am hopeful that they will pick up on this modification as well, to help other builders world-wide.

John also mentions substituting Spruce for Douglas Fir. I am not keen on this, for technical reasons.

John does not mention what plywood he used for construction. My guess is that he used birch ply, which is somewhat heavier than U.S.A marine fir plywood.

The relative densities are:
Spruce 25 to 38lbs per cu/ft
Fir 33 to 35lbs per cu/ft
Kiefer 32 to 35lbs per cu/ft
Birch 44 to lbs per cu/ft
Ex = Birch is 1/3 heavier than Fir plywood.

Another reason for the "Woodstock" weight increase is the exterior finish. If you look at the photographs of the prototype you will see that the ply surfaces were just varnished and fabric was confined to the area after the spar and not painted. Most builders fabric cover the whole glider and apply the usual scheme of dope, undercoat and final paint.

Even on a small glider like "Woodstock" a normal paint finish can easily add 20 to 30 pounds.

If it makes you feel any better the wings of my "MOBA" have sixty pounds (yes 60lbs) of putty and paint applied over the fibreglass and that is dead ballast that I cannot dump!

Gary Sunderland

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Dear Ed,

Thank you for the phone call requesting an input into our very own newsletter.

Firstly, many thanks for taking on the considerable tasks of editorship after Mark Stanley was unable to continue.

My own Woodstock project is coming together slowly due to work commitments such as overseeing the overhaul of Australia's oldest airworthy DC-3 for seven months of last year.

I have overcome the difficulties with the removable tailplane now that was part of the project when I took over from the original builder. If anyone is interested, I have lodge my modifications drawings with the G.F.A after their approval by Gary Sunderland my drawings, BMB-1. Address the particular difficulties I was presented with in fitting a horizontal stabiliser built separate from the fuselage and fin structure. My drawings should be read in conjunction with Ken Davies KD-1 (Drawings). I am sure that if I had started the project, I would have built it standard!

Currently my horizontal stabiliser is in a jig awaiting the fit most of the top skins. I have incorporated some home made anchor nut plates at elevator hinge so that they can be removed sometime in the future without having to cut holes in either the tailplane or elevators.

With the fuselage maintained controls systems soon to be completed, I expect to fit the rear turtledeck in the near future.

During a conversation with Peter Raphael at our first regatta at Ararat, it was suggested that we form a register of things that individual members or our group could contribute in the way of the specialised advise, abilities, equipment or access to specifics processes or material needed to complete our projects less painfully.

Could you James, perhaps include a form in a future newsletter, that willing members could complete and return to you for a record available to all in need of help!

I know we have a great range of talents within our group.

Back to Woodstock in general, it would appear that several of our members projects have finished overweight, I suspect that mine, with it removable tailplane modifications, will be no exception. Does any one out there have a scheme to modify the wings spars so that the original stress figures can be maintained with an overweight aeroplane (or pilot). An open letter to our newsletter could be beneficial to all of us.

Brian Berwick

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Dear Ed,

I found your address in Saiplane Builder the SHA publication from USA. Homebuilding is the name of the game and I am a former subscriber to The Australian Gliding. Too little about building gliders and a negative tone. Still I want to know about what's going on in the southern part of the world.

As you already know the Windex 1200 is an all Swedish construction and 8 are under building at the moment. EAA chapter 222, Sweden runs about 25 self launching projects all in all, of Monerais, Windroses and Stroijnik S2A. Some rebuilts or modifications and an AV222, a scratchbuilt project.

Just in these days we are waiting for a new law to be accepted. The chapter will then handle the building activity as it's own. Delegation they call it and there is already such on pure gliding activities since many years ago. In future everything seems to be put to EAA. Gliding is in a downdraft just now but it will recover on a lower level here in Sweden.

In our EAA-nytt (news) June 1996 Mr Anders Ljungberg reports from the FAI-CIACA meeting in Paris, France last April. Most representatives came from Europe at the conference. One of the issues were "Airworthiness Notice-Amateur Built Aircraft" using the web or internet for updating. A Frenchman Mr Pottier said what he thinks about authority things like that. The issue became a home lesson for next years conference. According to the report, Mr Ljungber, who has his background in "Luftfartsverket", (FAA in US) tells that the report will be sent to all parties all over the world, from these yearly meetings. I just want to check, because I want the whole world to know. The authority resistance movement just cannot win. March 1993 issue of Sailplane Builder, if available, will give you a hint about my strives for better regulations based on knowledge rather than guesses.

I am already looking forward to the first issue. Happy new flying season to all of you.

Nils-Anke Sandberg
Sweden

SHOP TALK

HOMEBUILDERS CORNER

by Gary Sunderland

This is a series devoted to amateur-built sailplane activities in Australia. It is hoped that information in this column will promote amateur-building in general and also assist those GFA members engaged in the restoration of home-built and factory-built sailplanes.

The genesis for this column is the "Homebuilder's Hall" feature in the USA "Soaring" magazine, to which we give credit. We trust that the series will prove equally popular and assist the resurgence of home-built glider activities here.

The early years of the GFA saw most members engaged in building and repairing their gliders. At the time this was virtually the only way to get flying. The introduction of factory-built sailplanes and full-time maintenance facilities in the 1950s and 1960s allowed the expansion of the soaring movement to its present size. Amateur-building virtually ceased except for a few hardy individuals like Keith Jarvis and Ted Pascoe.

Recent years have seen a renewal of interest in amateur building. Perhaps due to the high cost of buying and operating modern competition sailplanes many GFA members have recently become interested in the alternatives available in building one of the simplest and less expensive types of "sport class" glider or repairing an old sailplane. These offer the enjoyment of owning and flying one's own sailplane, together with the rare satisfaction of having constructed or rebuilt the machine from a collection of pieces to flying condition.

Amateur-building is conducted "for educational and recreational purposes". To those individuals so inclined it is satisfying in itself.

What sort of person can build his or her own sailplane? Many home builders were once model aeroplane constructors. If people have experience with glider maintenance and repair in their club they are obviously ahead. Trade skills and engineering knowledge are also assets to a prospective builder.

However, the amateur-built aeroplane movement shows that no special prior qualifications are necessary to build an aircraft. All you really need is enthusiasm and dedication. A little of the former and lots of the latter.

Of course there are many projects which get started with the best of intentions and fail to progress beyond a rudder or a couple of ribs. It is wise to take a critical stock of your situation and motivations before starting.

Have you the spare time necessary, the money to buy all the materials needed and a suitable workshop or garage available where the project can take shape?

Aircraft have been built under remarkably adverse circumstances by dedicated individuals but most successful projects result when all of the three requirements listed above have been met. Don't forget your family commitments.

Unless you have time, money and work space available you may be better off devoting what assets you have to club activities, or perhaps join a syndicate with a privately owned sailplane.

On the other hand it is not necessary, or even desirable, that you stop flying while you build your sailplane. You should keep soaring to remain in practice for the day your glider is completed.

Try to fly at least once a fortnight. The evening hours and the alternate weekends provide the time necessary to complete the normal project in two or three years. That may seem alot of lifetime to expend at the start but it is infinitely more productive than the alternative time one otherwise wastes watching TV or in some other non-productive activity.

Is it very difficult? Not at all! As noted above, all sorts of people can and do build their own aircraft. All aircraft materials used in home-built aircraft are particularly easy to work with simple hand tools. It is a lot easier to turn a piece of aircraft grade spruce into an aircraft part than it is to wrestle some knotty piece of hardwood or pine into a piece of furniture.

Incidentally, do not believe that metal sailplane construction is more difficult than wood construction or vice-versa. From experience I can state that the processes are equally simple and straightforward.

The secret of success is to concentrate on each small Step in turn and take pleasure and satisfaction in completing one part at a time.

An overall plan of progress is a good idea but do not force yourself to achieve any particular timetable. Racing against the calendar will only result in errors, slipshod work and eventual disappointments. Far better to take your time and let the work progress smoothly.

Another trap to avoid is making unauthorised modifications and substitutions. These can result in all sorts of effects which are not readily apparent at first thought.

Some modifications may be necessary and required to suit local conditions of operation and these should be sorted out and approval obtained well in advance of the building program.

I do not propose to get involved in encouraging a whole series of modifications to homebuilt sailplanes but I shall provide information on alternative materials and specifications in the series. It will then be up to the builders of the respective types to work together and obtain approval for any modifications they find necessary or desirable.

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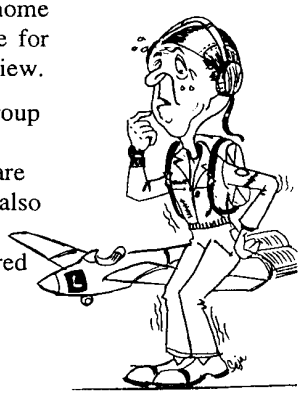
Following is an interesting article that doesn't have anything to do with home built sailplanes but is an example for all of us with a negative point of view.



Alex Adams has just joined our group because he likes to be involved in activities relating to gliding. We are in the same gliding club and he is also contemplating on building a Woodstock and has already gathered alot of information.

Read the story about his first solo flight at the age of 74. *(next page)*

Ed's Note.
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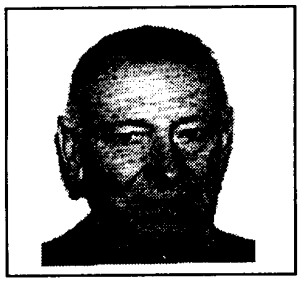
GLIDING"

WHERE THE SKY AND AGE HAVE NO LIMIT

by James Garay



Alex Adams is a member of the Geelong Gliding Club and one of the first students in Australia to take gliding lessons and achieve his first solo flight at the gracious age of 74. He's had 150 flights over a year and a half making a total of 60 hours.

Alex was born in 1922, since his early age he always had a passion for flying and he often dreamed of flying amongst the clouds besides the eagles in his home town of Hungary.

As the years went by his parents moved to Macedonia and the young Alex used to escape from home to the airfield nearby to contemplate and admire the big flying machines.

Many dreams of flight and fancy passed in his young mind but in this time the second world war erupted in Europe cutting off all the aspirations in him.

As a teenager he went to Austria seeking a better way of life and from Austria he migrated to Chile when the war was over. He always looked out for better opportunities far away from the devastated Europe.

His interest in flying never died and in Chile he used to ride his bicycle to the local gliding club to see the soaring activities in the nearby slopes of the Andes mountains. Many times he dreamed that one day he was going to be a glider pilot...but... at the same time a beautiful Chilean girl took hold of Alex's heart, they fell in love and married. Martha Adams gave Alex three beautiful children and to this day they are still very much in love.

Years passed by and after a few years in Chile raising his family the dreams of flying took a second priority and the Adams family moved to Argentina.

In 1973 again Alex felt the travel bug and migrated to Australia with his mind full of enthusiasm and desire to become a glider pilot one day.

In December 1994 he joined the Geelong Gliding Club after seeing a poster in the local butcher shop about gliding in Australia. Slowly, step by step Alex went through the difficult stages of learning how to fly a glider and finally after 150 flights and 60 hours total on Saturday 18th of May 1996 he went solo in his beloved ASK-13 club machine he calls "*My Girl*".

After the flight Alex returned to terra firma shivering with pride, at last his dreams have been fulfilled at the age of 74 years. While he was being congratulated by all the members of the Geelong Club his eyes showed a glimpse of satisfaction and a trickle of tears rolled down the side of his cheeks, maybe in his mind he forged this moment but deep in his heart he feels as young as a teenager, even more so when he is on his other passion....his motorcycle.

Alex was born in Hungary, raised in Macedonia, lived in Germany, Austria, Chile, Argentina and now he's a proud Australian true blue senior citizen.

He speaks 6 languages...he says! Home is where the family lives. This is home and I can call Australia home!

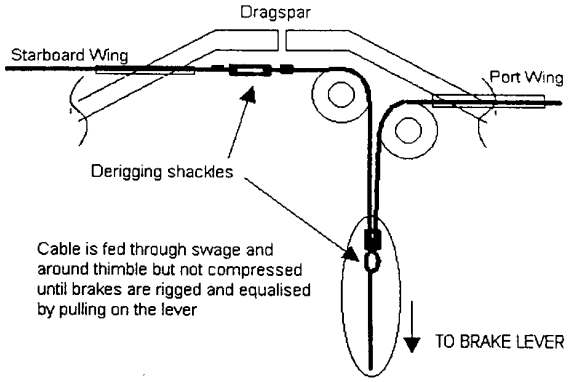
Shop talk

by Peter Raphael

As co-owner /builder of Woodstock VH-HNW (No.157) with its 6 years and some 160 hours of active service,our Editor has asked me to respond to some of the issues and questions raised by John Stockwell in his article in the last issue.

As John has discovered,virtually any modification one wishes to make will result in an all up weight increase and resultant loss of payload so these choices have to be weighed carefully against the possible gains.In our case, although we built with due care we also ended up over the design weight at 275 lb allowing us a payload range of 75kg to 84kg . Fortunately this is acceptable for my pilot + chute weight of 76kg.

If Johns concern with the divebrake system stems from the describes method of pulling on the lever to equalise the brakes then this,could be best explained by the following diagram which should make this pretty straightforward. We grappled with the notes for some time before the intention became clear.



John's trials and tribulations on constructing the canopy were reminiscent of my own efforts and perhaps a description of these may help somebody else.

Our basic frame was formed from 12 mm OD commercial aluminium tubing apart from the cockpit sides which are 20 mm OD tube. This is all socketed together at the corners with turned spigots made from aluminium sheet stock. These were subsequently pop riveted and epoxied in place and the corners then ground to match the contour of the tubing.
Shaped saddles were glued and riveted to the sides to provide a flat area to affix the canopy latches and 1/4 inch brass locating pins, reduced to 3/16 inch were placed through the frame and riveted over to locate the frame on the fuselage We used two in the front bow and one each side near the rear of the cockpit .The frame was made undersized to allow for the acrylic and fibreglass fairing also leaving a couple of millimetres clearance over the wing to allow for movement here.

The acrylic we used was 2mm cast acrylic,extruded sheet is cheaper but will not work as its internal stresses promote cracking and this resulted in my first failure. Merely wiping the edge of this material with methylated spirits to remove marking pen resulted in fine cracks radiating into the sheet and the application of glue or resin resulted in the same behaviour.

Acrylic can be cut easily with a cutoff wheel in a 4 inch angle grinder and this is far safer than sawing. Make a cardboard pattern (this is where you can determine how much headroom you will have). Once you have the blank cut it is advantageous to carefully clamp the acrylic in place on the frame and anneal it at about 80 degrees centigrade for several hours to relieve some of

the stress and make it easier to fit. I did this with a fan heater and some insulating coverings. At this stage I used two different methods to fair the frame as the acrylic I used was incorrect on the first attempt and had to be removed, I will detail both.

The frame was spirally wrapped with 1 inch fibreglass tape and fitted to the appropriately masked fuselage . The acrylic was clamped in place and countersunk self tapping screws were placed about every 3 - 4 inches through the acrylic and into the frame. This was then removed and coated with wax free polyester resin and filler applied to the frame before the acrylic is refixed over the wet filler (a mix of polyester resin and microballoons/Qcell etc.) This method can be very messy and makes it difficult to achieve a smooth frame, but results in a strong bond and rigid canopy.

Having had to remove this first canopy due to stress cracks appearing while gluing the top hat, I was able to strip the frame and then do most of the filling in the bare state. This was much easier but I still had the correct contours on the frame for the new acrylic. I think I would now attempt to do most of the filling first and fix down the acrylic on a thin bed of polyester filler later. It is essential to do most of the filling as well as the final fitting of the flat wrap, with the frame attached to the fuselage.

Our original "tophat" was commercially produced in 3 mm acrylic in a female mold of our construction and at exhorbitant cost. We have since managed through necessity, to reproduce these ourselves and at considerably less expense. If demand necessitates we may be able to supply these on request.

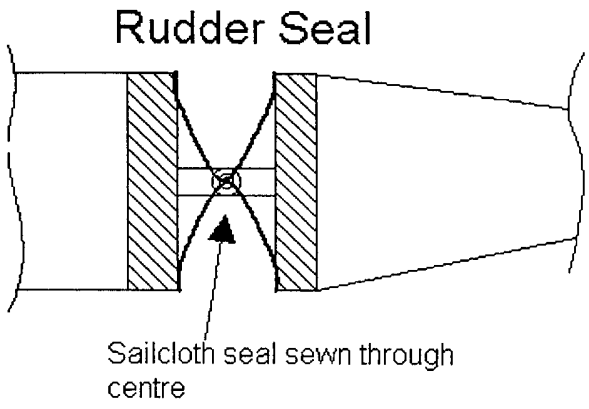
The "tophat" is trimmed to fit to the top of the canopy and is held down by tape and positioned laterally by small ply plates and fine copper wire twitches inside and out. This is then stitched in between with careful application of ROHM ACRIFIX 92ä (We obtained this from GFA) using a syringe needle to control the application. Being heavy handed and hasty will result in lots of bubbles and a wide glueline Once secure, removal of the twitches and repeated applications of glue will see an even joint around the "tophat". This produces a less obtrusive joint than fiberglassing and is compatible with the materials used. Acrifix instructions provide information on joint preparation and should be followed.

Acrylic rails were fabricated and fitted to the inside of the canopy before cutting the opening and a fitting a sliding window of conventional style to the port side corner.

The screw heads are filled and the frame painted, I used white gloss enamel . Cut a final paper pattern of the flat wrap and put it away and hope you will never need it.

A handy tip gleaned from Blue River System video when finishing our glider in this product was to spray a light coat of base colour over the masked areas before using the contrasting colour. Any bleeding likely to occur with then be in the same colour and will seal the masking prior to application of top coats. Needless to say that a proper striping tape should be used to mask the paint line and then the crepe type masking tape is placed over this.

Our rudder fairing comprises of two strips of sailcloth sewn down the middle with holes cut with a heated tube at the hinge points.This is then contact glued in a cross fashion to the fin and rudder spars. Somewhat lighter than wood structure.



The rudder cables run in nylon tube in the cockpit and aft fuselage areas. No additional guides deemed necessary.
The elevator cables also run in sections of nylon tube in areas of potential contact i.e.fin leading edge, Station 79.

Our hinge pins are retained by wire twitches inserted through a small hole in the last knuckle of the hinge. The pin is slightly shorter than the hinge to allow this, but can easily be pushed out with a piece of wire when removal is warranted.

A hand held Delcom radio is installed in port wing root leading edge with stick mounted transmit button and headset/mike unit . To power this and the VKW3 vario a 4 Ah Gelcell is clamped on top of the wheel box.

We elected to proceed with a fixed tailplane when we commenced construction as the removeable option was not flight tested at the time. I don't know what the weight penalties are but it certainly presents cleaner aerodynamics. Clever trailer design has overcome any perceived difficulties a fixed tailplane may have and it has not proved to be a disadvantage in transportation. The glider is strapped to a cradle and loaded on its side requiring a tall fin box on the trailer. This system is a subject in itself and may presented a later date.

Builders should accept that even through careful building they may not achieve designers weights and every additional woodblock ,bolt or screw added will in some way impinge on the final result. It is probably unfortunate that as practical people we homebuilders will add "improvements" as we go. keep in mind that this is your glider and as such must satisfy your needs and usage pattern. It does not necessarily need to be adjustable to suit all pilot sizes nor should it have a finish heavy enough to spent 20 years in the weather. That well built ,beautifully finished and heavily optioned glider will be no good to anyone if it is not allowed to leave the ground!.

Above all remember that enduring motto - "SIMPLICATE AND ADD LIGHTNESS"

Peter Raphael

TECHNICALITIES

WOOD ADHESIVES

by Gary Sunderland

Anyone building or refurbishing a wooden sailplane should read GS notes on glues and gluing techniques. Obtain a copy from your RTO/A or the GFA Secretary.

Although written some years ago the NGS notes are still reasonably up to date. Of the glue types listed Casein is difficult to obtain but you can still get it from Perfectus Airscrews, 175 Mason Street Newport, Victoria.

Resorcinol glue is generally available from aeronautical supply houses throughout Australia and is probably the best type in the long term. It poses some problems in the summer due to short working times and in winter you have to use space heating. A fan heater and some polythene sheet over the part overcomes this problem.

Another problem is shrinkage which results in distortion of the ply covering and thus increased drag.

About the only recent innovation is the introduction of Ciba-Geigy Araldite AW134 adhesive which has been developed specifically for use with wood and other porous materials. Being epoxy there is no shrinkage.

Not to be confused with normal epoxy resins, this AW134 epoxy is compatible with moisture in timber. Normal epoxy adhesives are sticky substances but do not "wet" porous surfaces very well and are inhibited by moisture. Consequently they do not penetrate timber as do wood glues.

The new AW134 epoxy overcomes this problem and provides good "wetting" and penetration of timber. This quality is particularly important for one application peculiar to amateur built sailplanes - gluing onto plywood formers and ribs.

Many amateur built sailplane designs, like the BG-12, Duster and Woodstock have formers cut from thick ply, rather than laminated from timber.

Consequently there is a problem in gluing the ply skin onto the edge of the plywood. The end grain of the latter soaks up wood glue, resulting in a weak glue starved joint.

The alternative of using an epoxy resin was often equally unsatisfactory, due to the lack of penetration of the ply skin and poor peel strength.

The new epoxy overcomes this problem completely. Samples tested by Charlie Lambeth were amazingly strong and exhibited 100% failure in the timber. The only problem is that the new adhesive is somewhat expensive but this can be minimised in construction by limiting its use to the critical "end grain" applications.

For supplies and details of Araldite AW134 and hardener HY994 write to Ciba-Geigy at the company's city office listed in your local telephone directory.

Scarfing Machine

A new type of plywood scarfing machine has been invented by Ron Robertson of Mildura, who was building a Luton Minor light aircraft..

Scarfing machines usually consist of a sanding drum mounted on a horizontal spindle, such as bandsaw shaft. The plywood is then held flat on a plate inclined at the desired scarf slope and passed underneath the sanding drum. A problem is that thin ply tends to buckle when being sanded.

In the Robertson machine the spindle is still horizontal but a flat sanding disc is used. The plywood is clamped vertically onto a wooden pattern, which is a segment of a cylinder and rotated against the disc about an inclined pivot.

The pattern is first produced off the same pivot bolt by sanding the laminated wood to a suitable radius. The plywood is clamped by a thin steel band to the pattern and due to the radius of curvature is more rigidly held than is possible with a flat sheet. Consequently the ply scarf is more accurate.

Fig. 1

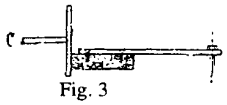


Fig. 3

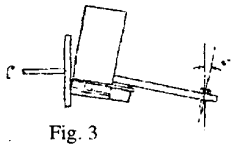


Fig. 3

HYPOXIA

by Dr Jeff Farrow

When you are building your own aircraft, be it a sailplane or something that fly's, how many times do you get into the unfinished cockpit and start to daydream about flying amongst the birds in the clouds. You leave behind all the mega buck ships and you fly higher and higher in your fantasies. Suddenly!!... you hear a knock on your workshop door. Your wife comes in telling you "Dinner is ready dear" waking you up before you reach the dangerous point of hypoxia. But don't worry, let Dr. Farrow tell us what it's all about.

The pilot of an unpressurised twin engine Seneca requested Melbourne air traffic controllers clearance to climb over weather to FL220. The aircraft had no supplemental oxygen. The aircraft was noted to climb to FL230. When contacted for clarification the pilot's speech was noted to be slurred and sounded intoxicated. The controller felt the pilot to be suffering from the effects of hypoxia. The pilot was requested to descend to FL150 at which time an improvement in his coherency was noted.

Hypoxia is an insidious condition which develops due to lack of oxygen in the bodies tissues. It is an inevitable consequence of flight at higher altitudes unless suitable precautions are taken.

The Physiology

Our bodies tissues, and especially the nerve and sensory tissues require a constant stream of oxygen to support their function. Oxygen is inhaled into the lungs into tiny air sacs called alveoli. These sacs are covered with a network of tiny blood vessels; capillaries, where the oxygen diffuses into the blood, and carbon dioxide diffuses from the blood under the effect of the pressure differences of these gases. Oxygen is then chemically bonded with a molecule in the blood; hemoglobin. This is carried in the blood to the target tissues. The oxygen pressure in the tissues are lower than those in the blood and hence the oxygen diffuses due to this pressure gradient into the tissues (and carbon dioxide from the tissues into the blood).

The essential requirement for this system to function is a pressure gradient for these gases between the atmosphere and tissues.

The Physics

Dalton's Law states the pressure of a gas is the sum of the partial pressures of its constituent gases. The air pressure at ground

level is 760 mmHg. Air contains approximately 21% oxygen so the pressure of oxygen at ground level is 160 mmHg. The atmospheric pressure halves every 18,000ft.

Unfortunately the situation is aggravated by a number of other factors. Air in the alveoli is always fully saturated with water vapour, and at body temperature of 46 mmHg. Also carbon dioxide production is constant by the body for a given level of activity resulting in a partial pressure of 40 mmHg (at higher altitudes; over 20,000, we breath more deeply and "blow" some of this out but it never falls below 24 mmHg).

Lastly as we remove oxygen form the alveolus the pressure of the remaining oxygen falls proportionately. Because of these factors the oxygen available in the alveolus falls with altitude to a greater extent than the fall in atmospheric pressure, see table below:

Altitude (ft)	Barometric Pressure (mm Hg)	Oxygen Pressure (mm Hg)	Alveolar Oxygen (mm Hg)
0	760	159	104
5,000	632	133	78
10,000	523	110	67
20,000	349	73	40
30,000	226	47	21
40,000	41	29	8

The body's one redeeming feature in this regard is the remarkable ability of the hemoglobin molecule to latch onto oxygen even when oxygen levels are low. Thus at 10,000ft (60% of ground level alveolar oxygen pressure) the hemoglobin still manages to carry 90% of the oxygen it carries at ground level (the "saturation"). Similarly at 20,000ft the saturation is 70% despite an alveolar oxygen concentration of less that 40% of ground level.

The Effects

The effects of hypoxia vary between individuals and are thus difficult to predict. They also depend on the time of exposure to the hypoxia. The following list represents typical effects for a fit young person exposed for a significant period (hours).

5,000
- Decreased peripheral vision and light sensitivity.

8,000
- Hyperventilation with tingling, light headedness, anxiety and possible muscle spasm.
- Mental fatigue and decreased mental proficiency.

12,000
- Drowsiness, lassitude
- Headache
- Euphoria and loss of self-criticism
- Disorientation
- Nausea
- Cyanosis (pale skin, blue lips and nails)

23,000
- Twitching
- Semi-consciousness
- Convulsions
- Coma

25,000
- Death

Exposure for shorter periods can usually be tolerated, the problem being to recognise when the symptoms are starting to occur in the presence of the impaired mental abilities, before the ability to take corrective action is lost, see table below:

Altitude (ft)	Time of useful consciousness	Time for coma
18,000	20'	-
20,000	10'	-
25,000	3'	8'
30,000	1'	2'

The Remedy

Since the cause of hypoxia in flight is a lack of pressure of oxygen to drive the transport mechanisms for oxygen in the body the remedy is to increase the oxygen pressure.

In a larger aircraft the cabin can be pressurised and the cabin pressure increased to a level where no significant symptoms occur (about 8,000' pressure in a modern air liner). In a glider this is not a realistic solution. Similarly the use of a pressure suit is not possible.

For unpressurised operations as in a glider supplemental oxygen is essential. In theory breathing 100% pure oxygen one can fly to 47,000' however the simple flow demand type oxygen systems used in gliders are incapable of supplying 100% oxygen. In fact they cannot supply reliably greater than 40% resulting in an operating ceiling of 28,000'. For higher altitudes a pressure fed system with a close fitting face mask is essential.

This still leaves the problem that all oxygen systems are subject to failure due to blocking of supply lines, exhaustion of oxygen supply or leaks in the system. It is thus preferred that pilots flying with the use of supplemental oxygen have experienced hypoxia in a controlled setting enabling them to recognise the symptoms and take corrective action. This facility was available with the altitude chamber at the RAAF Institute of Aviation Medicine; Point Cook, but with its transfer to Adelaide this is not longer so.

Pilot susceptibility to hypoxia depends on a number of factors. Smokers disable a significant portion of their hemoglobin with carbon monoxide, cold decreased blood flow, respiratory infections decrease oxygenation, some drugs and alcohol all increase susceptibility.

How high can a pilot safely fly without oxygen? Medically this depends on a number of factors, but the simple answer is 10,000 ft., this being included as a requirement of the Civil Aviation Orders.

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Woods Ain't Woods

"Looeys sez ya gotta use da good oil in ya motor!"

It's the same with timber for use in the manufacture or repair of wooden sailplanes.

For preference you should always use the timber species and grade intended by the designer and specified on the drawings or in the glider's repair manual when there is one.

If you are forced to substitute timbers then you must obtain an engineering clearance for the proposed change. The regulations require that this change must be documented and approved.

Be aware that "Aircraft grade spruce" is not precise specification, nor is spruce an acceptable substitute in many cases.

Spruce grows in the North America and is selected to meet various aircraft specifications, depending on density and grain
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slope. Selected spruce was the preferred material for aircraft spars, from the AVRO-504 of World War 1. To the Tiger Moth of World War 2. It also saw wide application in gliders, such as British Slingsby sailplanes and the Australian Kookaburra series.

In Europe the preferred timber was silver pine, from Eastern Germany or Poland. Also known as "Kiefer" (pronounced "kee-fir) in Germany species "Pinus Silvestris" grows all over the world but only timber grown in very cold climates provides the even grain required for aircraft parts.

"Kiefer" is significantly more dense and consequently heavier and stronger than spruce. Thus spars designed in Kiefer will have smaller cross sectional dimensions than a spruce spar, but about the same total weight. Silver pine was used extensively in German and Polish gliders, like the KA-7, KA-6, K-13, Bocian etc. etc.

When the KA-6 was built in Australia the "Kiefer" spars were imported from Germany, but spruce longerons and other parts were substituted in the fuselage.

The spruce longerons were increased approximately 20% in dimensions to compensate for strength.

Another timber which is similar to Kiefer in density and strength is "Oregon" also known as "Douglas fir" from North America. This has been used as a direct substitute for Kiefer in several sailplanes build in Australia.

For example the two ES-49 built by the Adelaide soaring club in the 1950s had Oregon spars. Douglas fir is readily available in Australia and at one time, the main use for selected Douglas fir was for making step ladders.

However, Oregon has one weak point in that the growth rings are very pronounced compared with the alternate timbers, making the timber more liable to split in critical places, such as at bolted joints.

There are some materials for which substitutes are really not possible. For example laminated beech to specifications TB-7 as used in the Schneider ES-60, ES-60-B and the Schiebe SF-27, as well as cold pressed beech TB-11 used in the LO-150 wing spars.

In these cases it would be extremely difficult to justify any other material as equal in structural properties.

Incidentally, obtaining a release note for any intended replacement material does not clear it for use as replacement.

The release not only confirms the material or part specifications.

In summary, stick to the designer specifications if at all possible. Have any substitution approved before you purchase them.

Douglas fir has long been the favoured timber specified in the USA for amateur designs in the "experimental category".

The reason being the price which is a fraction of aircraft spruce. Douglas fir is specified in the "BG-12" and "Woodstock" for example.

The price differential is not so great in Australia, as shipping cost for a major component of the final price here.

The main difficulty is to obtain the selected grade of Douglas fir intended by the designer. You should obtain advice from you local RTO/A and experienced builders.

A more difficult problem is to obtain a suitable type of plywood for your homebuilt glider. Many USA designs specify "Marine Grade" plywood, which in America implies a fir plywood. It is probably impractical to import USA marine ply, unless a material kit is available. The alternative is Australian marine ply, to 0.86 or later specifications.

This is certainly strong enough, but is usually from Queensland maple or similar species, which are slightly heavier than fir.

This can mean a significant increase in empty weight, and a decrease in disposable load, if there is a lot of ply in the construction. For example most Australian built BG-12 are heavier than the USA design and suffer accordingly.

Many years ago "Klinky" ply, from New Guinea, and "Hoop-Pine" ply from Queensland were available to marine specifications and would have been suitable substitutes. Unfortunately the small demand for these led to the supply ceasing.

Now and then someone mentions that hoop pine is again available but each time we find that it is only to a commercial non-structural grade.

Quite satisfactorily for model aeroplanes but not real aircrafts! The strongest plywood is birch mostly from Finland but it is rather heavy as a substitute in some exterior skinning applications. Note that Finnish birch is available in Australia in premium quality grade GL-1 and second grade GL-2.

Selected GL-2 contains one readily apparent external fault which must be cut out for the ply to be used in a critical area.

Grade GL-3 is also available and contains internal defects. Once again GL-3 is only good for model aircraft.

Another low density plywood is African Mahogany, or Gaboon ply, as used in the wing skin of the KA-6 sailplane. If it is still available it might be a possible substitute for USA marine plywood.

Gary Sunderland

ED - If any local designer and/or builders want advice on design allowables and properties of aircraft timber and substitutes don't hesitate to contact the AHSA or contact Gary directly. This data is available free to GFA members and Gary is only to pleased to help anyone with their sailplane project.

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CONSIDERATIONS - To build or not to build

by Lorenz Eckard

(Reprinted from Pacific Ultralights, March, 1996 Edition with kind permission)

Before you send away you hard earned money and pay 25% deposit on a kitplane, make an inventory of your personal surroundings and capabilities.

You will make a very important decision for yourself. There is nobody who guards you, or calms you down in your excitement. Let me wipe the dribble off your mouth and put you back on your feet.

When you tell your friends you want to build an aircraft, most of them think: "Yeah, now he got another of his stupid ideas, he won't finish it anyhow. What an idiot." They tell you: "Great, what a wonderful idea."

If you are married it's just the other way around. Your wife will probably tell you, what an idiot you are, but deep inside she will adore you. (That's true love!)
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Analyse every comment you will hear. Let's have a look at the finishing rate of homebuilt aircraft. We have to look at scratchbuilt projects, which are made from plans and where you have to organise the materials, and kits where most or all of the materials are delivered.

Naturally, the lowest rate of completions is found in scratchbuilt projects (around 4%). To organise parts for aircraft can be a real nightmare. It's very time consuming to find sources if you live in the countryside, away from major cities or airports. I gave up and imported most basic stuff direct from the Kitplane supplier or from one of the excellent U.S. companies, which will send you their catalogues. These are the homebuilders bible's, because you will find a lot of good advise and you will learn a lot about aircraft specifications and materials. The tool sections are full of useful and not so useful stuff, depends on your project and your budget. It usually takes 10 to 14 days to receive the parts, but you will have to look at some hefty freight bills, which double the expense.

A fax-machine is very handy, because with the time shift, you will find it difficult to phone at midnight or very early in the morning. You also want to explain some problems of your project with a little drawing and a comment. Post that, and you lost 20 days at least in waiting for an answer. There are answers you will prefer to get in writing as well.

With kitbuilt planes, the completion rate is 63%. This is much more than scratchbuilt and reflects the problems of getting your parts for yourself. Still, 63% means nearly half of every kit project lies in a shed or double garage, gathering dust.

The reasons for this are diverse. Some builders made mistakes, which are difficult to repair or need new parts, which are highly problematic to ship. Just think of a nicked aluminium main wing spar. There you are. Big question is, just how good can a company in U.S.A. wrap a single 4 or 5 meter aluminium tube, that goes to San Francisco first, may survive an earthquake, gets whacked on a ship, unloaded in Australia somewhere, put on trucks and trains and gets tossed around in freight yards? If that happens to you, you're in for some interesting weeks.

Some builders don't follow the manual and work on too many parts of the project at the same time. This can be very disencouraging. Some steps command your full attention, day and night. You try to solve a problem here and some solutions take days to ripen. Go fishing, or do the lawns. Your head will spin if you try to tackle 20 or 30 problems at the same time. Then add the factor of interconnections between them and you very fast have a situation where you are bogged. You can't do one thing, because the other isn't finished, or one part doesn't fit, but you don't know how to connect another one without this one. It's called accumulation burnout, a typical example of builder meltdown.

Then there is another species of builders, who have all the time in the world and build just for fun. Mostly retirees, they enjoy building so much, that they just don't want to finish. Their aircraft are perfect, when finished after a decade or two, but the pilot is mostly lifted into the modified cabin on a stretcher, next to the extra amplified headsets, a drip ready for infusion and on the underside of the wings you will find these clamps, (crutch clamps?)...just kidding!

Other builders get the shock of their lives, when they open the crate for the first time. They just put that nail back in again and don't touch anything. This opens a rare opportunity to buy an "unfinished kit" for someone else. Some are just running out of money.

As soon as you get the papers, check the options list. You may find some surprises there, or would you think of a propeller as an option? They tell you in their catalogues, that everything to finish that aircraft is included in the kit. You might wonder, what you want to add. Paint is an option, because different builders want to finish differently. Instruments is another one, some can't get enough of them. Do you need tools, do you really need bush tyres? All this very much depends on what you will do with your plane. Throw flower bombs on neighbours house, or spy on Fergie at the pool. Some builders park them in the garden or use them as an outhouse, there is so much you can do with an aircraft. Some even fly them.

But let's go back to analysing these comments you get. They are an indication, a feedback where you are and how the surrounding world responds to your idiotic ideas. Don't take them easily, they are the field where your seeds will grow, or not.

A.I.D.S (Aircraft Induced Divorce Syndrome) is eared amongst builders who proceed without full consent of their better half. Plan the finances together and allow for the unexpected. Kitprice + 1/3rd = completion.

On top of this, allow for registration costs, inspections and insurance. Do you have a license on this type of aircraft and can you test fly you creation, or do you need a test pilot? How much time does you test pilot have to complete this? The list goes on and on. Let's make an example:

Kitprice US	$21,500
options US	$3,500
freight US	$2,500
AUS$	$35,000
tools	$1,200
paint	$2,300
fees	$1,500
Total	$40,000

You need to transport the finished aircraft to an inspection or an airfield? Do you have a trailer? Can you borrow one? See, the plane hasn't flown yet but consumed a healthy 40 grand already. If you told your wife, the kit just costs $21,500, boy, you will be in trouble very soon.

This does not include allowance for your working hours you put in. If it is the first aircraft, double or better triple the advertised building time. 400 x 3 = 1,200 hours.

If you work for $25/ph that makes = $30,000. The whole lot represents a value of roughly $70,000. Is it worth the whole trouble? Well, decide for yourself. You will have a brand new aircraft, you can maintain yourself. You know every rivet and bolt, have assembled it at least three time and you have become an expert.

Buying a plane from a dealer, means you get the keys and know nothing. I very much doubt if a factory can invest so much time in details and finish as homebuilders invest. It would certainly not be economical.

Do homebuilders do mistakes? Yes. But, consider the time and money invested, wouldn't you as a builder make 100% sure, the aircraft is airworthy?

The finished aircraft is inspected through various stages of the construction and is very thoroughly inspected at the final inspection through C.A.A or S.A.A.A inspectors. The test pilot will do a very close inspection again, again, before he departs.

And you will keep a very close eye on everything, when he comes back. There is absolutely no point in building an aircraft, which doesn't fly safe, except if you want to kill yourself.

Building an aircraft yourself is a very rewarding experience, when finished. Beware as most builders will tell you, it is addictive as well.

MAGAZINES/JOURNALS

In this issue you have been reading "Considerations" To build or not to build. This article is one of a series written by Lorenz Eckard and this was compiled into a booklet "A Slice of Heaven". Things you should know before you start building your own aircraft (AU$15 inc. p&h, 38 pages A4). Published and printed as another true home brew product by :- Lorenz Eckard, 15 Angus Crescent, Kureelpa Qld 4560 Australia.

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Two excellent publications for those interested in early aeroplanes, scale models and history "WW-1-AERO" and "Skyways" are published in USA. These two publications are the brain child of Leonard E. Opdycke who has been an administrator and teacher of English and mathematics in schools and colleges since 1951. His early interest in aeroplanes then to getting a private pilots license, then to building and flying a full scale Rotary-Power Bristol Scout replica. For more information write to the publisher :- World War 1 Aeroplanes Inc., 15 Crescent Road, Poughkeepie, N.Y 12601, USA. Phone - (914) 473 3679.

Book Review

"Personal Aircraft Drag Reduction" by Bruce Carmichael. 207 pages and 195 illustrations contains information on aircraft drag reduction beyond streamlining. The cost US$35. Publisher :- Bruce Carmichael, 34795 Camino Capistrano, Capistrano Beach, California, 92624, USA.

WHAT'S NEW!

A Date to Remember

Next year from January 4th to 11th, the "Vintage Gliders Association of Australia" will hold The Annual Regatta at the Bendigo Gliding Club Airfield, Raywood,Victoria.

The A.H.S.A in conjunction with them will join in a get-together from 9th to 11th for our second Annual Regatta. Winch and aerotow will be available so keep the date in mind and start to polish those magnificent flying machines because there will be prizes for the best!

New Members

We have new members to welcome to the group

John M. Harris - 3/20 Seaview Rd, Port Augusta SA 5700
Carlo Gleeson - Lot 2 Jollys Rd, Teesdale Vic 3328
Heinrich Nowack - 28 Aleja Crt, Noble Park Vic 3174
Robert Tyler - 4 Dubin Crt, Wantirna Sth Vic 3152
Gerry Fratel - 172 Kooyong Rd, Rivervale WA 6103
Alex Adam - 18 Angourie Cres, Taylors Lakes Vic 3038
Nils-Ake Sandberg - Skönsmogatan 25 S-85462 Sundsvall SWEDEN

WELCOME ABOARD fellows and we look forward to a long and mutually satisfactory association!

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October 13-19 National Vintage Glider Rally, Gympie in conjunction with Gympie District Gold Rush Festival. Enquiries to Ron Baker (07) 3203 8318, Unit 11/1 Rock Street, Scarborough, QLD 4020.

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"Sailplane Builder"
Official Publication of The Sailplane Homebuilders Association U.S.A $29 (airmail $US46).
Dan Armstrong, Secretary/Treasurer, 211100 Angel St. Tehachapi, CA 93561, USA.

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Pacific Ultralights - Twelve monthly issues for only $45. P.O. Box 731, Mt. Eliza, Vic 3930 Australia. Overseas subscriptions, credit card accepted.

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"Twitt" (The wing is the thing)
Twitt is a non profit organisation whose membership seeks to promote the research and development of flying wings and other tailles aircraft. Yearly subscription rates : US$18 inside US, outside is US$22 12 issues per year. For more information write to PO Box 20430, El Cajon, CA 92021, USA.

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Attention "Woodstock" builders
"Woodstock" sailplane sketchbook illustrated construction manual US$25. Also available are drawings for simple jigs used to construct various components. Package deal of sketchbook and all jig drawings US$85. Overseas customers add US$15 for airmail delivery. Send S.A.S.E for more information to C. Brooks, 2231 Vuelta Grande, Long Beach, CA 90815, USA.

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FOR SALE "Cherokee" fully restored, ground handling gear, trailer. Gary Morgan, PO Box 822 Sutherland, NSW, 2232 Ph. (02) 525 4352 a/h

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WANTED "Tost" release to suit Woodstock or suitable drawing to make one. Brian Berwick - 4 Grandview Rd, Belgrave Heights, Vic, 3160. Ph. 9754 5510 a/h.