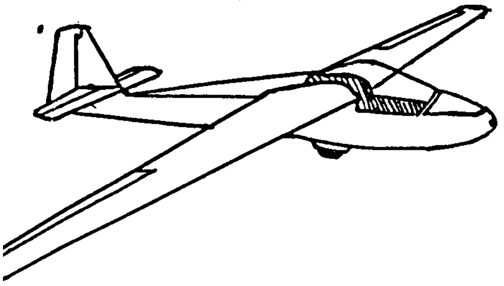


XMAS - 94 ISSUE

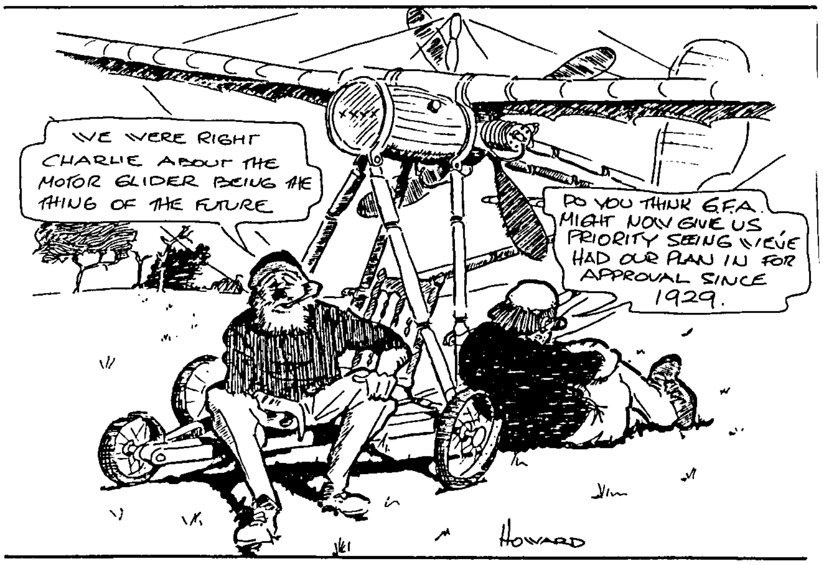
The HOMEBUILT SAILPLANE ASSOCIATION

P.O.Box 503
LOXTON,5333
Sth Australia
AUSTRALIA.

ISSUE No-2, JAN-1995.

EDITORS CORNER:

G'DAY FOLKS, Firstly,it's a bit late but Merry Xmas and happy new year to all!
No-2 issue will have a slight motor glider flavor as intrest in these machines is on the increase as you are probaly aware, I myself don't have allot of imfo on motor--gliders,but I'll put what I've got to print.
Mike Burns tells me that at present,approx 70% of glider manufactures aircraft are motorgliders,so its fairly obvious where the glider trends are headed.
I think its fairly safe to say that the future of homebuilts will go in the same direction, our first motorglider in OZ was flying as early as 1934 so bolting a noisy little engine on to a glider is certinly not a "new" thing.
Cortesy of Australian Gliding magizine I have a story on the early days of this side of gliding.



Also,we have details of a proposed design by Mike Burns for a low wing motorglider that he has called the TAREE,it has very pleasing lines and is of all timber construction with an empisis on building out of timbers that are readily avail--able in Australia.
Garry Morgan is also designing a 15m motorglider and expects to begin construction around next winter,this is a compisite design of metal and fibreglass.
Garry has not yet forwared any 3 views to me yet but when he dose, I'll pop them in the newsletter.
I've also poped in a few 3-views and some genral imfo on other designs that are around the place.
As per usual,a request go's out to all of you to send in any imfo,storys etc that you may have as we all want to hear about them and it'll make my job here a little easier.
Anyhow,on with the newsletter.

DEATH OF A DESIGNER.

It is with regret that I anounce the death of Jim Maupin ,designer of the WOODSTOCK, WINDROSE,and the CARBON DRAGON sailplanes.
Jim died in January of 1994 after a prolonged bout with Emphysema,he was 72 and he died at home with his wife and five children beside him.
Jims family is continuing to offer plans and support for his designs,there is supposed to be a memorial statement in this months SOARING(Nov) magizine from the U.S.A.
I never met Jim but from his letters he struck me as a man who like allot of us,lived to go soaring in your very own machine,he will be sadly missed,but his designs will keep his spirt alive and well.
Thanks go to Mark Fisher for obtaining this imfo from the Internet system for us.

LETTERS OF INTREST:

All of your letters are intresting and I await them with bated breath,but a couple of them have been just that bit diffrent,the first is from new member Mike Valentine and his dog "Jeddah",(or is Mike Jeddahs human??),who has sent his "small offering to promote the cause",I felt you might like to read what Jeddah Valentine wrote.
My dog "Wally"(or am I Wallys human??),could not resist the urge to write back to Jeddah,parts of both letters are printed for your viewing.

The second letter is from another new member,John Stockwell,who is our first "overseas" member,as he resides in Hong Kong and is building a WOODSTOCK in a 15th floor flat in the middle of Hong Kong!!!!!!!
He has promised me (after some bribeing)that he will write a story on the homebuilding scene and what it is like to build a glider up high,in the middle of Hong Kong,it should be rather intresting to say the least!!!
Anyhow,on with the DOG letters.

Dog Tails

Dear Woofer,

Rumor suggests that one of your attendants has determined to encourage the pursuit of building one's own glider,is accepting hard cash and dispatching a newsletter to that purpose.
Presumably this deciple has been warned of the dangers inherent in producing aerial drink cans,FRP flexible fungus,etc,and has recieved instruction to chant the Home--builders Creed"Wood is good",three times a day before or after meals.
In order to ensure your apostle is commited to the promulgation of good deeds and decries the temptation to follow the nerd herd in the pursuit of the bottemless pit of extravagant glass one of my retainers has been instructed to forward to your attendant some small offering to promote the cause.
If the clot has the renumeration incorrect just forward a doggynote & he will be chastised.

Grrrrrr

Jeddah Valentine

BITS OF WALLYS REPLY.

Dear Fellow Woofer,

The scandilos rumors of one of my attendants forming a pile of timber into a very poor replica of a wedge tail eagle,is I am ashamed to say, TRUE.
MUCH DRIBBLE FOLLOWS ON FOR QUITE A WHILE SO WE'LL SKIP IT AND REJOIN THE REPLY FURTHER ON.
Con't, Your retainer did get the small offering right,I have it in my HOT LITTLE PAW, all donations are gratefully accepted to further the cause of the lost in the FORREST type who got lost while out looking for a tree long enough to get a new set of spars out of but first had to find a creek to drink from to fill the bladder so they could then MARK the said tree so he can find it again,just as soon as he finds the way out of the FORREST that he got lost in ,in the first place when he was out looking for that tree for that set of spars ,that needed to be marked to find again,after he found the creek that he was trying to find but couldn't becauseas you may have worked out from what I have said,THE BLITHERING IDIOT IS LOST,the only reason that I know this much is that the IDIOT got me on his mobile phone to tell me he was lost,just before the BATTERY'S went FLAT,so I am still waiting to hear from him again,I think it could take a while!
The letter ends with, WOOF WOOF WOOF

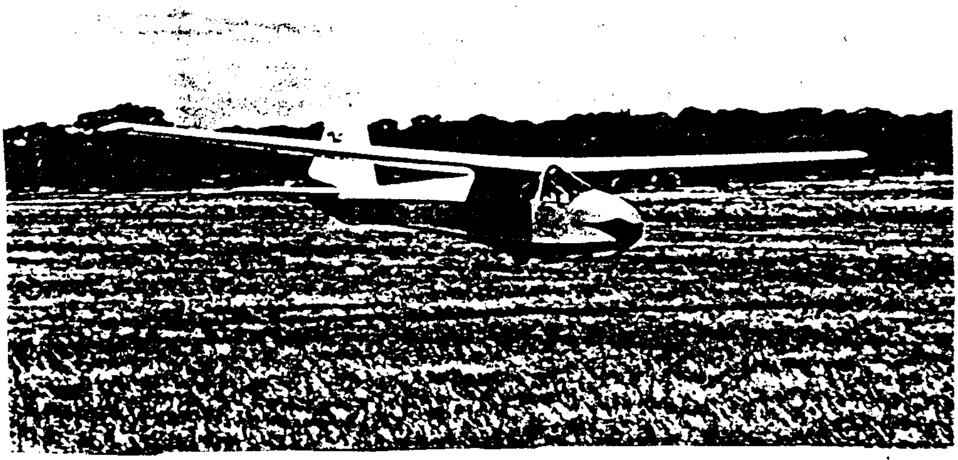
WALLY STANLEY

The one other bit of wisdom that was in Wallys reply is this, **IF GOD HAD WANTED US TO FLY FIBREGLASS GLIDERS,HE WOULD HAVE PLANTED FIBREGLASS TREES.**

HMMMMMMMMMMM,so much for the doggy notes,on with the newsletter I say!!!!!!!!

Builder Profile

Well fella,s,No 2 Builder profile will be about your editor as I havn't had anyone send any story's to me yet,I guess they are all just about finished .(Hmm,Ha)
I started flying in Febuary of 1979 at the Leeton gliding club,as my family was shift--ing around a fair bit I also then shifted around a few clubs,they are as follows, after Leeton came Sunraysia GC,Lake Bonney GC,Waikerie GC and finally Renmark GC.
I work full time at the Waikerie GC in the Glider maitinance shop,but have my ES-56 NYMPH based at the Renmark GC as It is only a 20min drive to where my WOODSTOCK is being built,so I head to the WOODY on the weekends and build if the wheather is not so good,and go fly my NYMPH if the sky's looking good,it's a bit of a strange setup,but works fairly well.
Due to all our shifting around it wasn't until March 1983 that I finally went solo,a long time to get there,but better late than never!
My first loop happened in Feb of 1983 and this got me hooked on aerobatics,after this the world was being turned upside down at every optunity,the outcome of which was wanting my own glider to do the aeros in,the first thoughts were for a SALTO or a Pilatus,both of which I couldn't afford and the banks didn't want to know about anything with wings,so then my thoughts turned to building my own,a much modified WOODSTOCK came to mind so I contacted Terry and Peter (from our last builder profile) and aranged a visit to Towcumwal,were their WOODSTOCK was based.
On arrival it was love at first sight and I "had to have one",plans were ordered,a workshop was built and approvals in principle were obtained,all was going well,and after hassling Mike Burns for around 4 1/2 months(!),with phone calls,fax's etc,(SORRY -about that Mike!),it finally hit me that by the time I paid for all the design change to the airframe, it was going to cost approx the same as a Pilatus,there ended my modified WOODY project,I went out and bought my beloved NYMPH .



The NYMPH on takeoff Renmark airfield.

NYMPH - 1956 (ES-56)
12m WINGSPAN
25:1 glide
All timber.

A couple of years went by and the itch to build hadn't left me,so when the partly completed WOODY project of Trevor Killmiers turned up,I tried to ignore the call, things like,can't afford it,what do I want 2 gliders for,it's not aerobatic etc all failed to stop me going for "just a look",yes well now it's home in my shed,HMM.

I've been at it now for a few months,it dos'nt look much diffrent,as I'm doing allot of smaller parts in the fuz as I want to finish it off first,currently,it's approx 2/3 complete (the fuz) and the wings,stab and fin have the spars mostly completed and some of the rib work is done,basically I've still a fair way to go with it.
I decided that we needed a self help group for homebuilders,and the only way to get one,was to have a go at it myself,and here we are.
As I progress,I'll pop in updates on my project,as I said last time,please put pen to paper and let us all know about each other,bye for now.-MARK STANLEY.

THE BANK

Just in case anyone is intrested, we now have a Bank Account,it's with the Bank of S.A here in S.A.,it has an intrest rate of 1.75%,which is a little higher than thier normal savings account and also there are no monthly charges that normally whittle away at small acounts like ours.

NEW MEMBERS Welcome abord Fella's,good to have you's.

No-11, Mike Valentine, (VIC), Owns KA-2b,and Jeddah the dog

No-12,Alvin Petersen,(VIC), Wants to build a winch first.

No-13,Tim Berkes,(VIC),Wants to build a kit motor glider

No-14,Graham Holland,( ),Genral intrest in motor gliders,paticuly the WINDROSE.

No-15,Gary Sunderland,(VIC),Convenor of the Design and Development Commitee for GFA.

No-16,Dave Donald(QLD),Built Monerai,want to build another sailplane.

No-17,John Stockwell,(Hong Kong),is currently building a WOODSTOCK in Hong Kong.

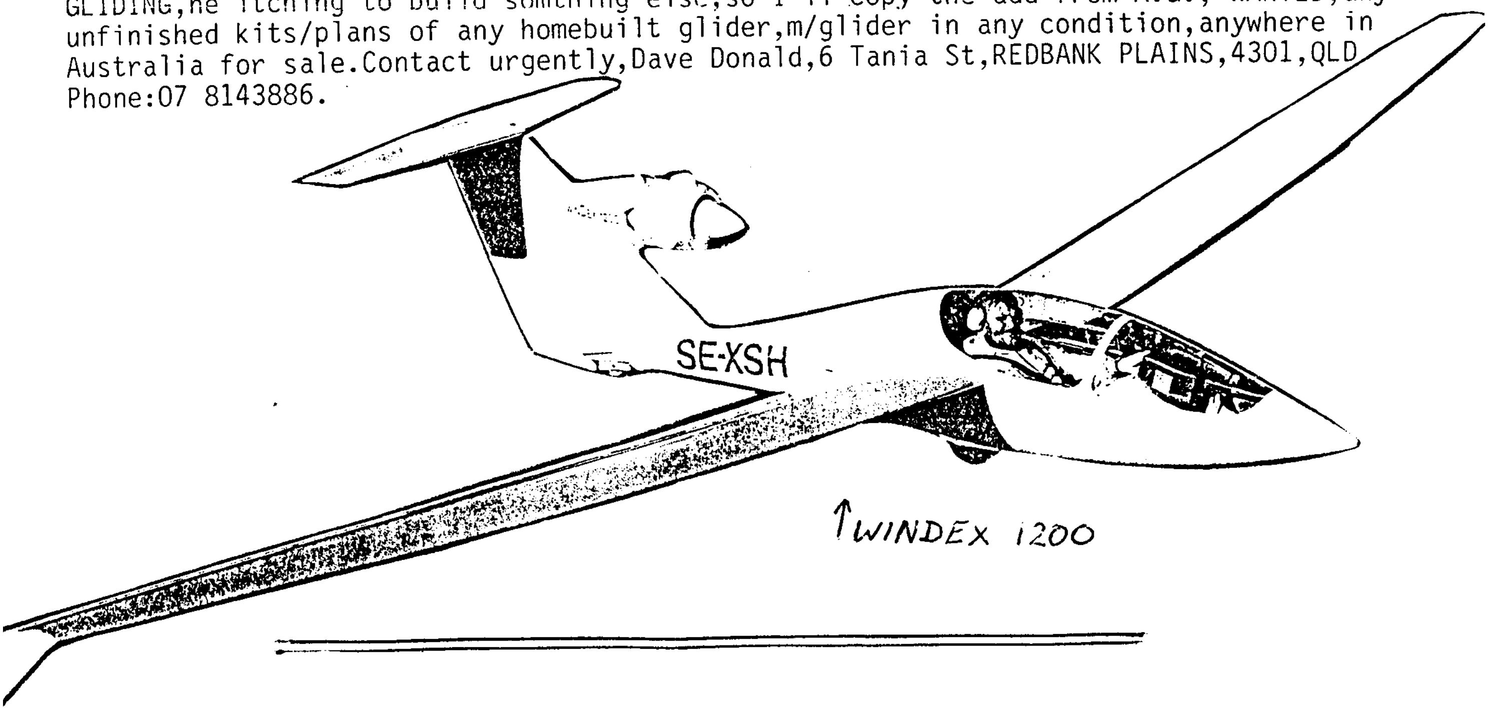
No-18,Wayne Rhodes,(W.A.),Wants to build motorglider and possibly a EP-2

WINCHS

One of our new members is going to build a winch and needs a bit of help,he has decid--ed to do the following:Dual Drum,Trailer mounted,Rope instead of wire for launching. He is not sure of what engine size or Diff size/ratios and drum size's to use on his winch,I have sent him a copy of the recent article from Australian Gliding to help him on his way,but if any one can help with any info at all,please contact:Alvin Petersen, P.O.Box 18,EMERALD,3782,Vic.

HELP,I WANNA BUILD!

Another of our new members needs a hand,he recently finished a MONERAI(VH_XOY),but regretably had to sell it,so now as you may have seen in the November issue of AUST GLIDING,he itching to build somthing else,so I'll copy the add from A.G., WANTED,any unfinished kits/plans of any homebuilt glider,m/glider in any condition,anywhere in Australia for sale.Contact urgently,Dave Donald,6 Tania St,REDBANK PLAINS,4301,QLD Phone:07 8143886.

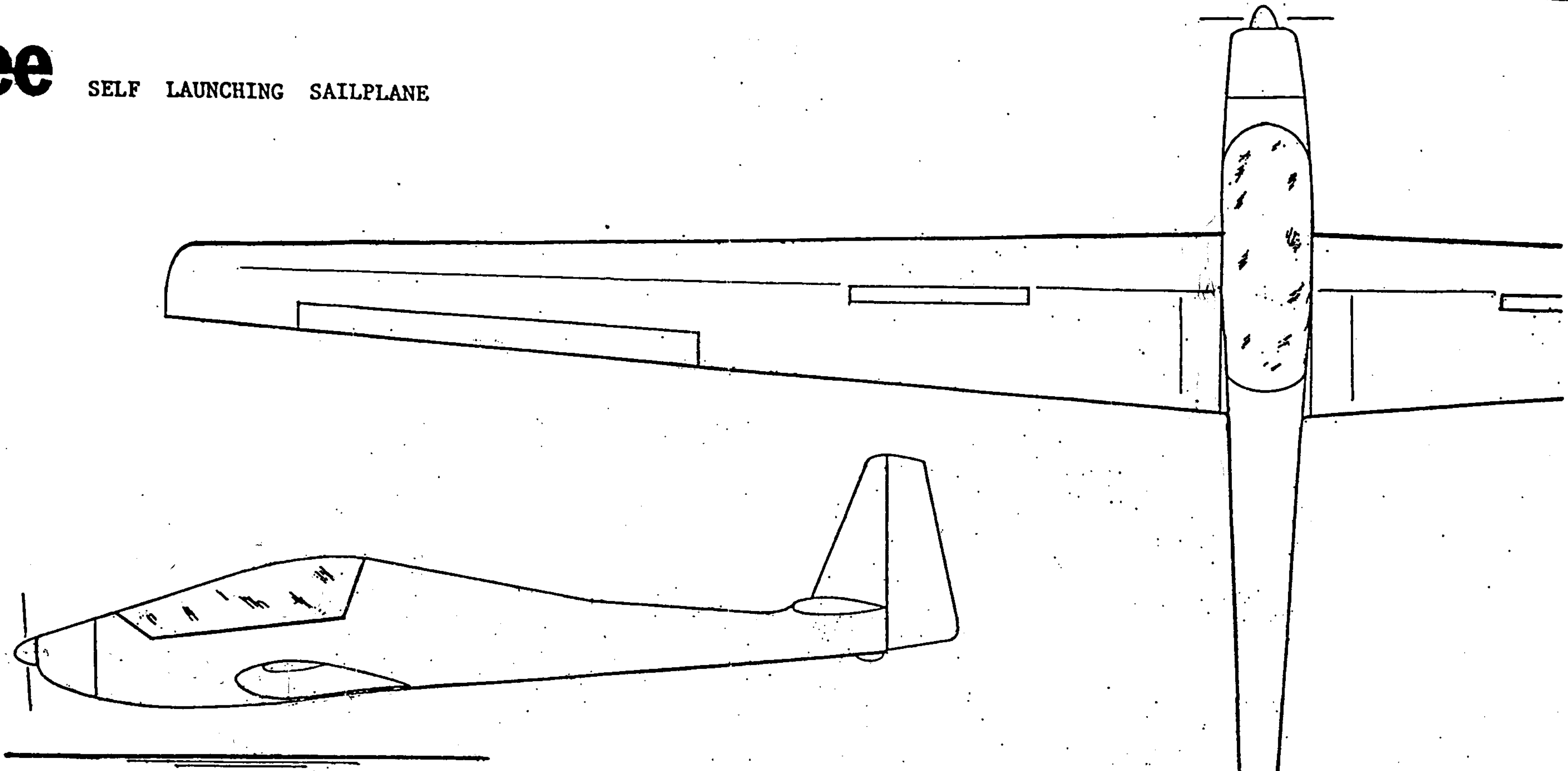


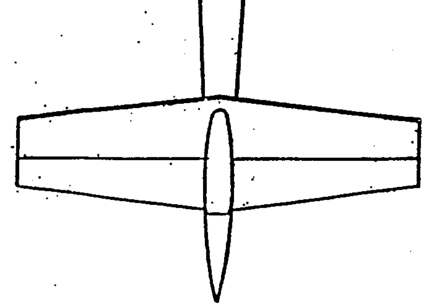
↑WINDEX 1200

THE — TAREE

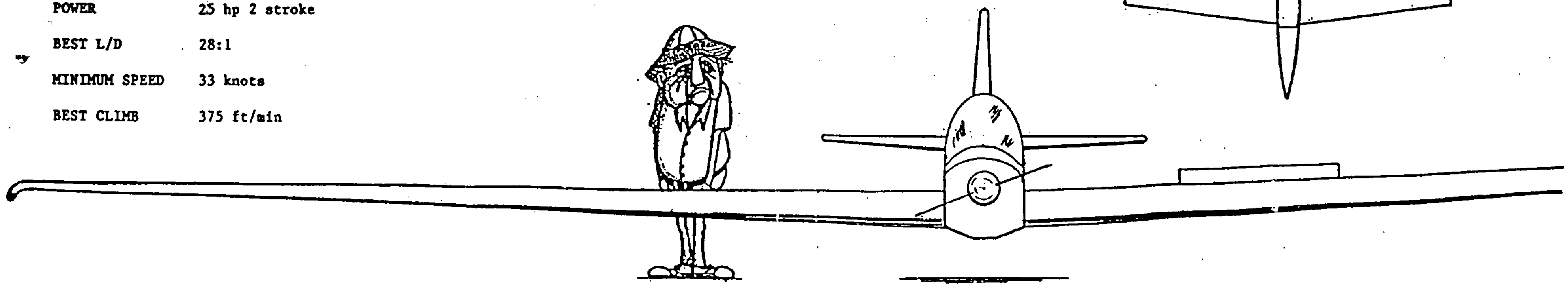
The following 3 pages show Mike Burns design the TAREE, no plans are avaialable at this stage and thier production depends on "intrest shown",so if you like what you see give Mike a call at Aviation and genral engineering,PH-058-742914(BH).
As more imfo becomes available,I'll stick it in the newsletter.

Taree SELF LAUNCHING SAILPLANE





SPAN	15 meters
WING AREA	12 sq. meters
GROSS WEIGHT	310 kg
POWER	25 hp 2 stroke
BEST L/D	28:1
MINIMUM SPEED	33 knots
BEST CLIMB	375 ft/min



When Jim Maupin designed his "WOODSTOCK" glider he followed in the footsteps of many people who have pursued the concept of small, light, low cost sailplanes. He set four main goals by which the WOODSTOCK design was guided:

(1) Use the least expensive materials, adequate for each part of the sailplane.
(2) Use as little of those materials as possible.
(3) Keep it simple and light.
(4) Exploit fully the use of commom parts.

"TAREE" is an effort to continue that line of thought and concept into a simple, low weight, low cost Self Launch Sailplane.

TAREE ITS PURPOSE.

The TAREE has a simple purpose "To provide low cost simple access to self launching for those who wish to thermal and wave fly independent of aero tow and wire launching".

TAREE THE COMPROMISES

To achieve its purpose there have to be compromises :

(1) Performance.
As a pure sailplane, engine off, it has a best glide ratio of 28:1 combining with a minimum speed under 35 knots to provide good thermalling capability, losing out on cross country performance.

(2) Structure.
To avoid high design, development and tooling costs wood is the primary structural material, combining with fabric and some composites to nett the lowest weight airframe. This is at the expense of not achieving laminar flow aerodynamics.

(3) Power.
The low weight structure allows the use of a small, simple 2 stroke motor which will help to achieve low operating and launching costs. The developed power will provide performance adequate for safe operation and certification, no excess.

TAREE WHO IS IT FOR ?

If you want 40:1 glide, 750 km capability, high performance competition and so on, the TAREE is not for you.

If you enjoy local soaring, up to 300 km tasks, exploring wave and other atmospheric conditions and perhaps Sports Class competition, then thats what Taree is all about.

Suitable for the homebuilder in drawing or kit form, and both private owners and clubs when purchased complete.

TAREE ITS CONSTRUCTION

Construction is "classic" timber technology combining with modern glues, fabrics, finishes and composites.

Questions of fatigue, maintenance, repairability, systems access, serviceabilty, are all catered for by careful detail design based on the accumulated experience of the gliding movement. The aim being to produce a product with a 40 year life at minimum on going cost.

As much Australian material as possible is used in the structure and systems, ultimately an Australian engine will also be able to be installed.

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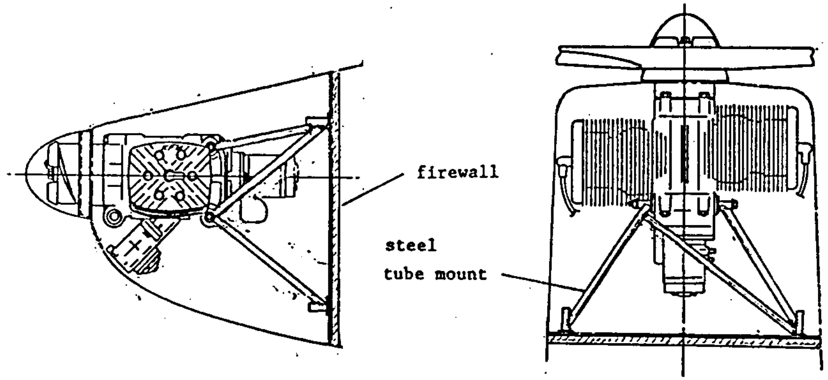
POWER PLANT

KFM 170 MOTOR



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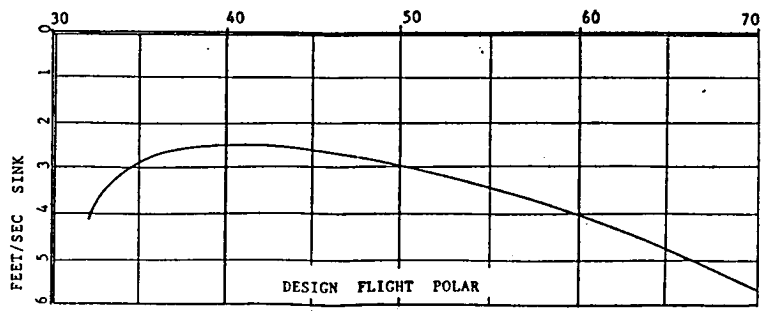
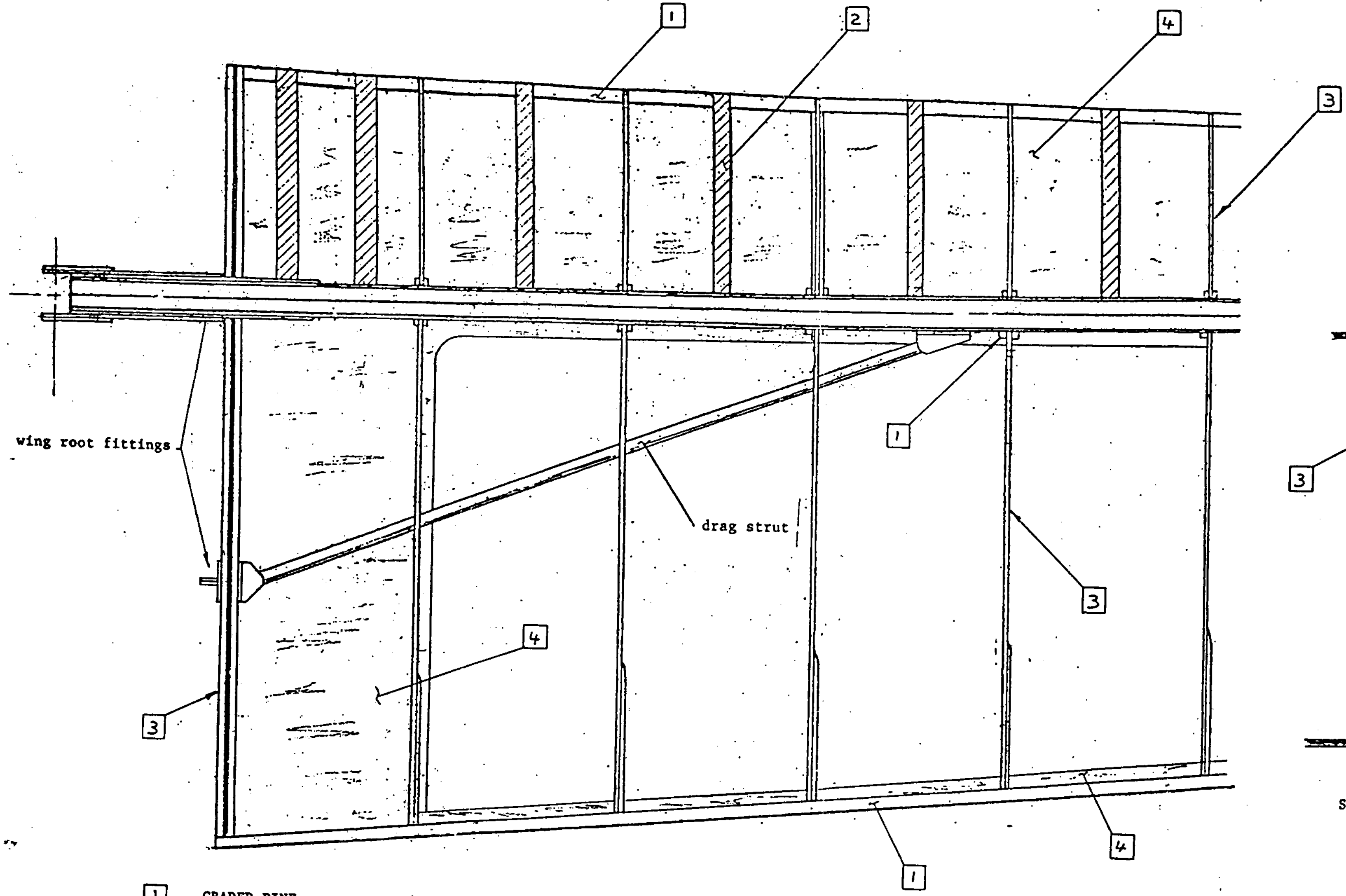
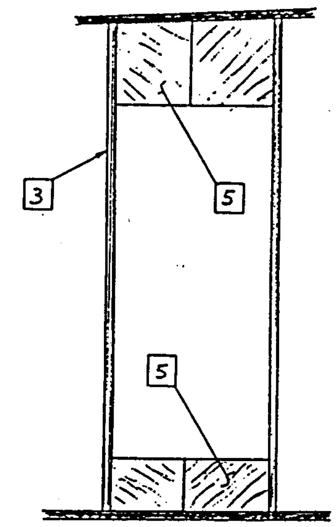
PERFORMANCE.



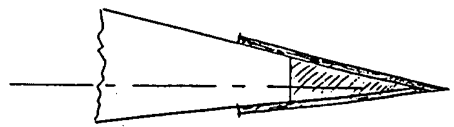
Taree MISCELLANEOUS WING CONSTRUCTION DETAILS (schematic)



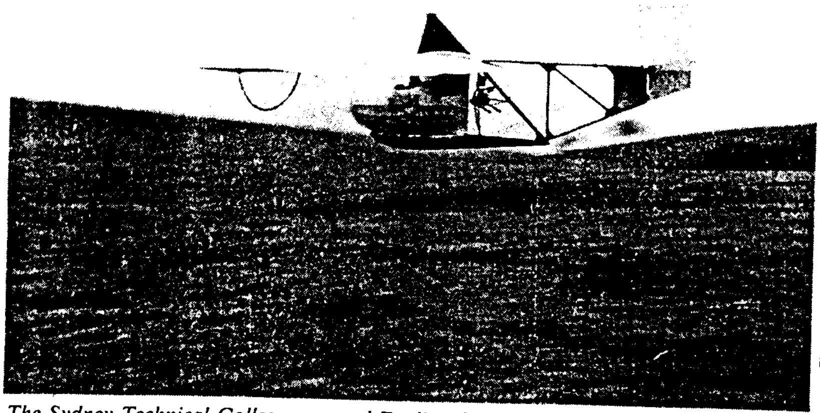


SPAR CROSS SECTION

1	GRADED PINE	(non structural)
2	PVC FOAM	(stiffening)
3	HOOP PINE MARINE PLYWOOD	(structural)
4	AIRCRAFT BIRCH PLYWOOD	(structural)
5	DOUGLAS FIR	(structural)



TYPICAL TRAILING EDGE



The Sydney Technical College powered Zogling flying at Schofields, NSW, in 1938.

Australia's first powered gliders

The first motor glider to fly successfully in Australia is believed to have been a Zogling primary, fitted with motor cycle engine and a pusher propeller.

According to Allan Ash's book *Gliding in Australia*, a man called R. Murry made the flight in 1931, assisted by the Metropolitan Power Gliding Club of Melbourne, a club devoted exclusively to power gliding.

At first, Murray hoped to fly his self-built aircraft, powered by a 2hp Coventry Victor engine behind the pilot, driving a 6ft diameter propeller mounted above the wing.

Ash writes: "The Zogling was duly tested and, not unexpectedly, was found to be underpowered.

"As a result, Murray fitted a four-cylinder Henderson engine which enabled him to maintain height after being launched by car tow."

Another experiment about 1938 involved fitting a 390cc ABC motor-cycle engine to a nacelled Zogling primary glider.

The conversion was done by members of the Sydney Technical College Gliding Club.

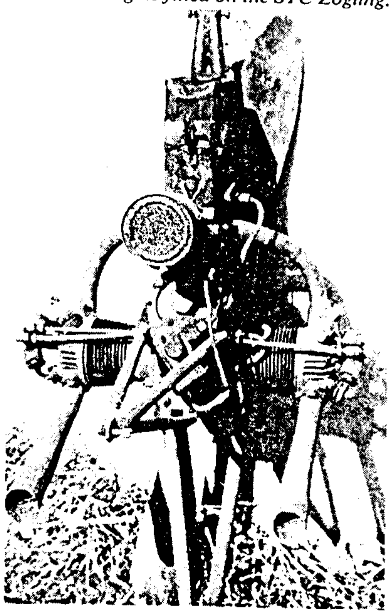
The engine provided enough power for the glider to maintain height after being car-towed.

The twin-cylinder horizontally opposed engine was mounted behind the nacelle and drove a tractor propeller.

Club members flew the powered Zogling for many months before it was "landed" on a tree.

The "landing" did little damage but getting the glider out of the tree resulted in extensive damage and it was never repaired.

The ABC engine fitted on the STC Zogling.



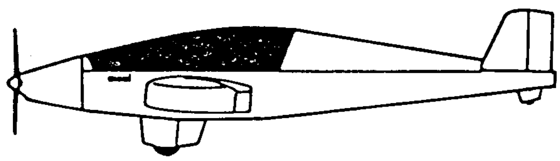
MONI

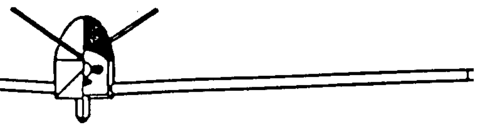
SPECIFICATIONS

span	27'6"
length	15'
height	39"
wing area	75 sq. ft.
empty weight	260 lbs.
gross weight	560 lbs.
useful load	240 lbs.
fuel capacity	4 gal.
endurance-full throttle	2 hr.
design limits	+ 6 g's − 4 g's

PERFORMANCE (sea level)

glide ratio	20/1 at 50 mph
cruising speed 75%	110 mph
top speed	120 mph
stall speed	38 mph
T.O. distance	400 ft.
range at 80 mph economy cruise	320 miles
rate of climb	500 fpm
engine	KFM 107, 2 cyl. 22 h.p. electric start
cockpit will accommodate	6'4", 235 lb. pilot
building time	500-600 hrs.





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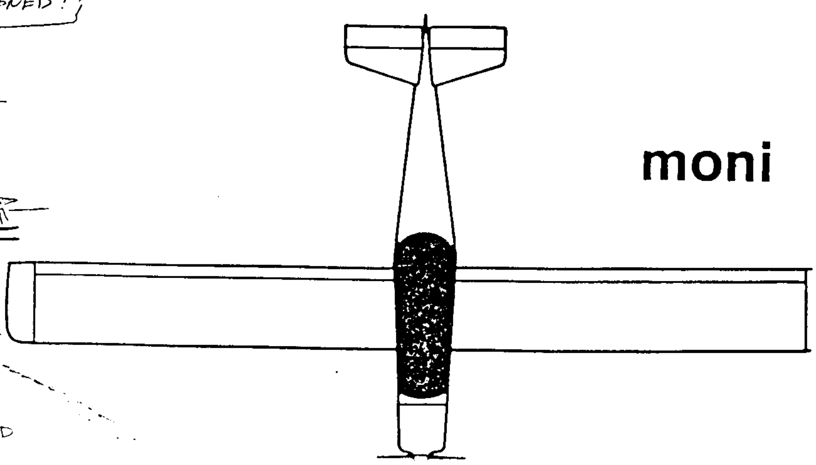
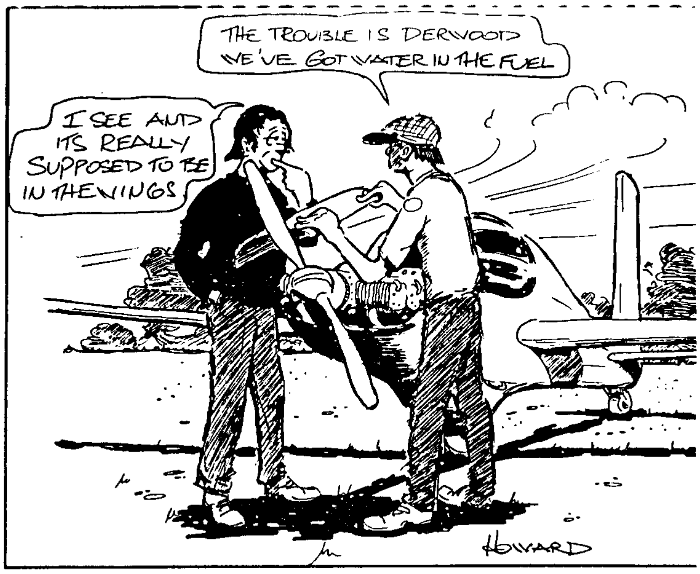


Home Built Motor Sailplanes

HOMEBUILDER'S CORNER
by Gary Sunderland



By far the most popular subject in correspondence to this column relates to motor gliders, otherwise known as self-launching sailplanes or motor sailplanes, call them what you like.

I have previously steered clear of such requests for information, initially because I wanted to first establish this column to assist glider-builders. I feel that the amount of effort required to finish the average home built sailplane is usually enough without complicating it by adding a motor!

Another good reason is that, despite widespread interest and experimentation in recent years, there are no proven designs available which fulfill modern requirements for performance, safety and utility.

This situation could very well change in the near future as there are many developments now taking place, particularly in the USA where the SSA home-built contest has sparked many new design projects.

Readers may also be interested in recent developments here in Australia.

It may be worthwhile to first specify the subject in more detail.

The name motor glider is often taken to refer to two-seat training aircraft like the Motorfalke and the RF5B Sperber. These are particularly useful in the out-landing check role and can be operated under power for extended periods.

Consequently a reliable VW-based engine is invariably adapted. This is fitted to the nose, for reasonable cooling, with a steel fire-wall to isolate the occupants from any hazard. This latter deflects most of the oil and fumes overboard. Effectively motor gliders are a cross between a sailplane and a light aeroplane.

Modern self-launching sailplanes, like the PIK-20E, on the other hand, are dedicated soaring craft. With the engine folded away they are true high performance sailplanes and can operate in direct competition with normal sailplanes.

The SLS motor usually is retractable and is commonly a very light two-stroke. Although the engine can sometimes be operated for extended periods it is more usually used only for short periods, for landing and to avoid retrieves.

The SLS is usually fitted with tow-hook so it can be launched by orthodox means, unlike the motor glider which is grounded by an engine problem.

The term Motor Sailplane has been derived to cover both classes in Australia. Minimum performance limitations have been nominated which motor-sailplanes must meet to be eligible for a Certificate of Airworthiness in this new category. These require a minimum climb gradient of 7% (i.e. 7 metres per 100 metres) and a maximum rate of sink of 300 feet per minute (1.5 metres/sec.).

By its nature a two-seat motor-glider is not the sort of project normally tackled by amateurs, although we have previously reported two such projects under way. Wally Williams is rebuilding a Motorfalke in W.A. and Tom Hinton is planning to build a Fournier RF9 in Victoria.

In the self-launching sailplane category there are a few developments of interest. Photo 1 shows the well-known J-1 Joey home-built sailplane designed and built by Keith Jarvis in South Australia.


Photo 1: Joey

If you examine the photograph closely you will observe a strange projection above the centre section.

Photos 2, 3 and 4 show how the Australian-built 160 cc two-stroke engine is mounted onto a strut vertically above the wing.

A design feature of the Joey is its extremely small size and light weight. Consequently a small pilot, like Keith Jarvis, can fly the converted aircraft within the 180 kg (397 pounds) maximum take-off weight limit of ANO 95.10. This particular Air Navigation Order exempts certain very light aeroplanes, such as the powered hang-glider types, from normal airworthiness requirements.

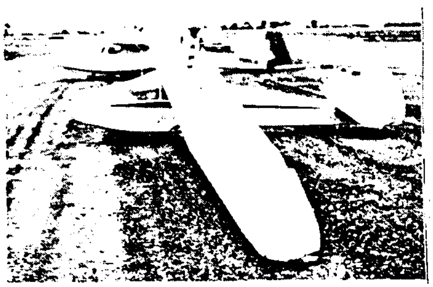


Photo 2: Joey

Flight performance of the motor-Joey is impressive for so little power. The rate of climb seemed to be adequate, at least on a reasonably cool day. Quite an achievement on an engine with one-tenth the capacity of a VW and producing only 6 HP estimated!

Soaring performance with the motor ticking over is good but Keith described the power-off glide as "like flying with dive-brakes full out".

Before anyone departs to bolt a chain-saw engine onto their Standard class glider or home-built it should be pointed out that such an exercise is pointless.

Apart from such a modification being contrary to Air Navigation Regulations we already know that an orthodox 15 metre sailplane can fly on as little as 15 HP. Designing a useful and practical self launching sailplane is rather more difficult.

The trick for a self-launching sailplane is of course to retract or fair the motor so that the pilot can proceed with the normal business of soaring. The beautifully engineered PIK-20E installation shows what can be achieved in a production sailplane but this sort of refinement, in the design of the motor and propeller installation, is perhaps too difficult for an amateur project.

If the complication of engine retraction is not possible, designers are reduced to trying to fair in the engine as best they can. Photo 5 shows one attempt. Although the Hornet designed by Dave Betteridge in South Australia is strictly an ultra-light aeroplane to meet ANO 95.10 limitations it shows what might be possible for a sailplane development.

The Hornet has a span of only 7.9 m (26 feet) and wing area of 12 square metres (130 square feet) so it is truly an aeroplane not a sailplane. The claimed best gliding angle of 16 looks somewhat optimistic from a wing with an aspect ratio of only 5.

The power plant installations are of most interest to us. Optional engines are the Konig three-cylinder, two-stroke radial producing 30 hp at 4500 rpm and

Photo 3: Engine mounting

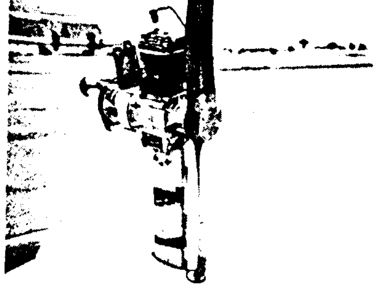
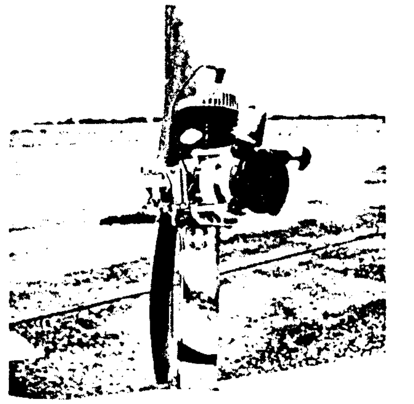


Photo 4: Engine mounting



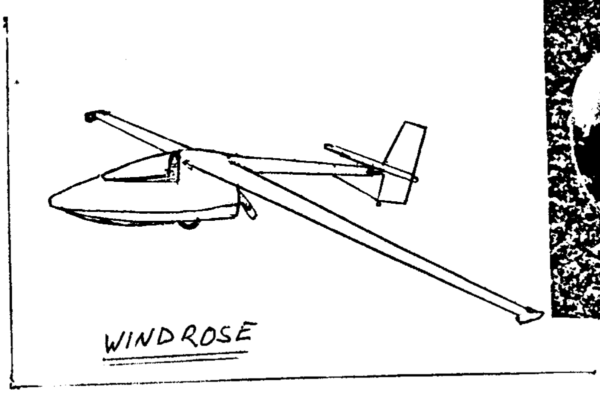


Photo 7: Monerai engine

the Lock Kaird two-cylinder four-stroke producing 36 hp. The Konig weighs only 15 kg (33 lb) including electric starter and silencer.

Either of these engines would provide ample power to launch a sailplane and one could imagine that a system of ducts and gills could be devised to fair the ducted fan installation completely when not in use. A sailplane along thse lines would have to adopt a pod and boom fuselage or be a flying wing like the Hornet.

Of more direct interest is the Monerai-P designed by John Monnett of Illinois, USA.

The Monerai is of course a kit sailplane for home-builders and the P suffix refers to a power-pod conversion on offer to prospective builders. Details of the powered Monerai are shown in Photos 6, 7 and 8.

It will be noted that Monnett has taken great care in fairing the motor but, unfortunately, this location is the very worst from the drag point of view. While the basic Monerai evidently has a reasonable performance in the Sport sailplane category it remains to be seen if the Monerai-P is a viable soaring craft.

A Monerai-P is being built in Victoria by Greg Peter who is making good progress. While the engine location is not ideal at least it has the advantage that it may be easily removed and the Monerai can then be flown as a normal sport sailplane.

Whether the powered Monerai can be approved will depend upon experience gained in the USA and flight tests to be carried out in Australia at some time in the future.

Another powered sailplane home-built which has created some interest is the American Eaglet kit from the USA. At least one example is being built in Australia, by Don Bradford in Victoria.

The Eaglet is a pod and boom design with a strut-braced high wing, rather like a modern-day version of the Bowlus Baby Albatross.

The 12 hp engine and a folding propeller are mounted at the rear of the fuselage pod.

The most unusual feature of the Eaglet is the inverted V-tail which doubles as the tail skid! Hardly the thing for a normal rough grassed airfield, let alone paddock landings. For this reason alone the Eaglet is hardly a viable powered sailplane.

Like the powered Monerai the performance of the Eaglet is unsubstantiated. It is notable that both types were at Oshkosh in 1981 but, according to Charlie Lambeth, neither demonstrated their flight capabilities, at least while Charlie was looking.

In addition to the minimum certification requirements we really need somewhat better performance if we are to fit such aircraft into the existing GFA fleet. Because our two-seat training gliders possess best gliding ratios of 25 to 30 it is reasonable to look for a similar minimum performance in a home-built design. In fact all the successful home-built glider designs have this level of performance.

If the home-built powered sailplane is to be developed to the level of safety and performance required in Australia then there is still quite a lot of work to be done yet.

It is worthy of note that all of the powered sailplanes to date have used air-cooled power plants. This is logical where the engine is retractable but not necessarily so for a fixed installation. The need for adequate cooling air flow in a fixed installation means that the designer must provide drag-producing scoops and ducts.

One alternative approach, which has not been explored to date, would be to adapt a water-cooled motor completely buried within the fuselage. If we were only interested in intermittent operation for launching then we would only require a small quantity of cooling liquid, sufficient for some ten minutes of operation before the liquid boiled. The pilot would then shut down the motor, feather, or preferably fold, the propeller and commence soaring operations. Such an installation might be simpler to engineer and at least as efficient as a retracting motor.

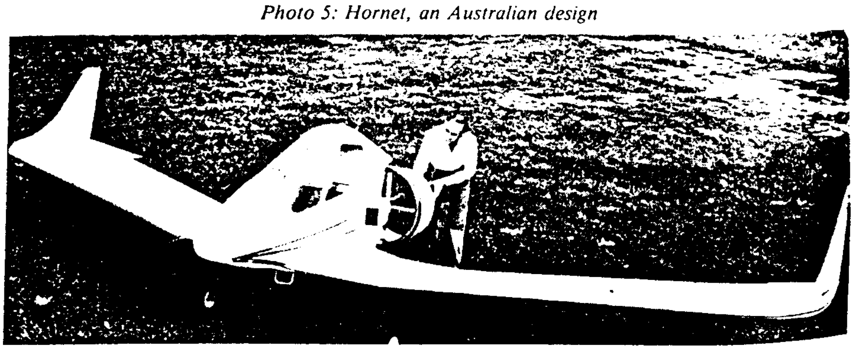
It is apparent that many of the so-called powered sailplanes currently flying have so little soaring performance that intermittent power-plant operation is hardly considered. The motor has to be used continuously to keep the device in the air. This is due to either high span loading, low aspect ratio wings, or alternatively high-drag power plant installations. Most amateur designers do not even bother to retract, fold, feather or otherwise streamline the propeller!

These observations may be considered somewhat negative. However, please contemplate the following proposition : This summer you might try a launch behind a Tiger Moth or a very sick Auster, on a hot and turbulent day in nil wind with your glider full of water. Imagine a launch failure at an awkward moment and plan a landing with the dive-brakes jammed full out. These performance parameters approximate some certificated motor-gliders, let alone home-builts!

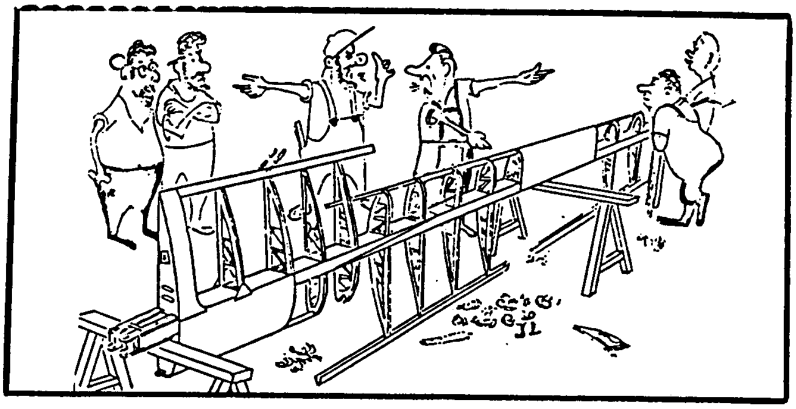
Added to your worries in some cases we have a large lump of metal strategically placed to belt you over the head in a crash, plus a fair quantity of inflammable fuel ready to spill and an electrical system all ready to supply a source of ignition to the resultant mixture. Hardly a happy thought.

For these good reasons I am not prepared to recommend any home-built powered sailplane type at the moment. Should the situation change then I will be only too happy to provide details through this column.

Photo 5: Hornet, an Australian design



BUILDER BITS



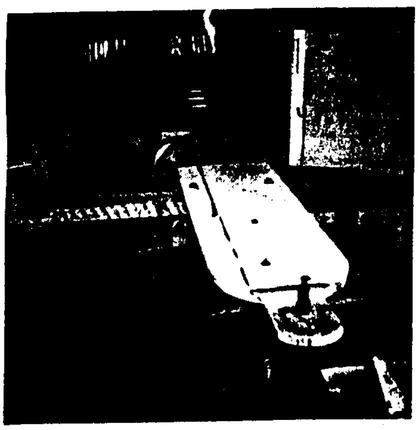
FOR THE TIMBER TYPES:

The following is and old report from Gary Sunderland on a scarfing machine that was designed by a friend of mine a few years ago when he was still building his "Luton Minor" power plane.(it's flying now) The machine is fairly easily built (and Cheap) and puts out a good product,the drawings are self explanitory.

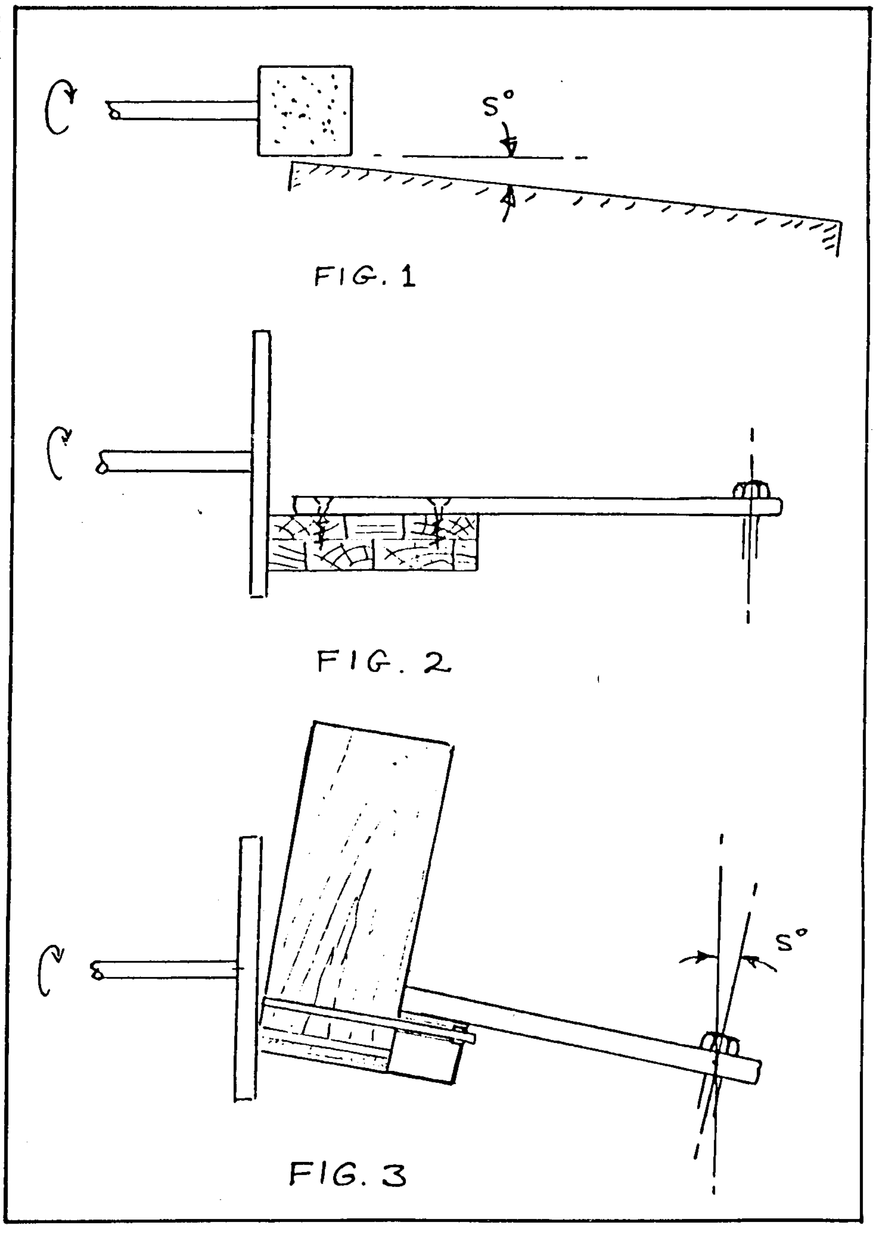
A new type of plywood scarfing machine has been invented by Ron Robertson of Mildura, currently building a Luton Minor light aircraft.

Scarfing machines usually consist of a sanding drum mounted off 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 (Figure 1). 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 on to 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 (Figure 2). 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 (Figure 3). Consequently the ply scarf is more accurate.



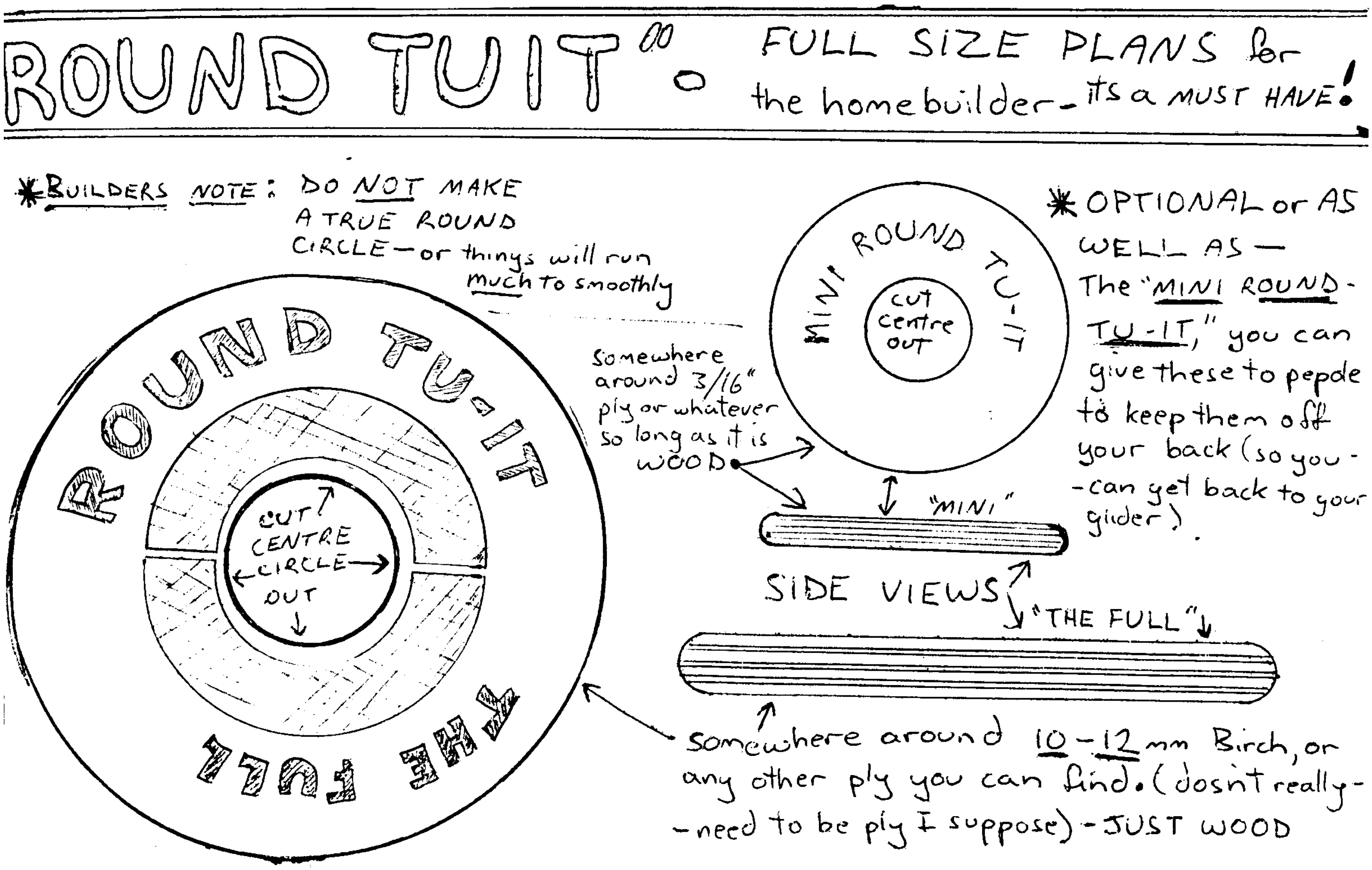
Above: Plywood scarfing machine. (Photo: Ron Robertson)



Another couple of articles from Gary to follow on from the scarfing machine are on STEEL PARTS,their manufacture,welding and presivation,all good stuff and worth a read, finally,and article on the possible "adverse" reactions of various types of glue for those that are rebuilding or continuing a project started a long time ago.

DESIGN and Development

Gary S underland is a fairly busy lad,he has a job as an RTO/A in Victoria and acts as an advisor for the Design and Development Commitee in the G.F.A.,he spends one day a week at G.F.A. HQ to, as Gary puts it,"attack the backlog".
He tells me that the main job of the D&D is to advise the CTO/A,John Ashford,on matter -s relating to the type clearance and acceptance of amateur category sailplanes.
On our Motor glider theme he informs me that so far the information on the MONERAI glider looks OK and he has recommended that the CTO/A issue these with Certificates of Airwirthiness,the powerd version of the MONERAI is similar,except they need hard numbers on performance,sufficiant to compile Flight Manual strip lenght and climb graidant information,this in turn waits on GFA advisory info on sailplane performance testing.
He advise's that these projects will be completed when various GFA officers get a **ROUND TUIT !** ,as such being the now world famous,helpful group that the H.S.A. is I have at great risk obtained a plan of the **ROUND TUIT** and have forwared a copy to GFA HQ,also for the benifit of those who do not have one in thier shed,I have copied
CON"T- the plan onto this here page,be warned,it is **TOP SECRET** and you will be shot at dawn if it is found in your possesion,so either hide it,or destroy it once you have it in your memory banks.
DO NOT LET YOUR PARTNER,PARENTS OR WHOEVER see it,as they normally want things done **NOW** ,and can't see the value of the **ROUND TUIT** .
Anyway,if you hassle Gary about somthing,please be paitent,as he will get back to you as soon as he can get a **ROUND TUIT,O.K.**



The US-designed Monerai, a successful homebuilt sailplane with a bolt-on engine.

AN OUNCE OF PRESERVATIVE...

One detail which is not covered very well in kit instructions and plans, if it is mentioned at all, is the need to protect metal parts from corrosion.

There may be no strict requirement to protect the metal at all. Clad aluminium sheet is to a large extent protected at manufacture by a thin skin of pure aluminium over the structural alloy. In fact, many factory-built light aeroplanes are produced with little, if any, internal protection. Alclad parts are left untreated and many steel parts have just a light coat of zinc chromate primer.

This saves time and money for the manufacturer and cost for the first buyer of the aircraft but, in the medium and long term, results in corrosion problems and the inevitable expensive repairs. The amateur-builder generally is prepared to spend some time and effort to produce the best possible result. Knowing what to do is more than half the battle.

Corrosion is the result of a chemical action in the presence of water. A typical situation involves two metal parts in contact, such as a steel bracket bolted to an aluminium part. With a small amount of water added, a miniature electric cell exists, leading to a flow of current and oxidation of the aluminium. Because atmospheric air always contains a fair proportion of water, which will condense out on contact with cold metal parts, we have a common situation.

It is not necessary to have two metal parts in contact. Another element can provide the necessary conditions. For example a "lead" pencil actually deposits carbon on the marked surface and if a carbon deposit is in direct contact with aluminium, corrosion results.

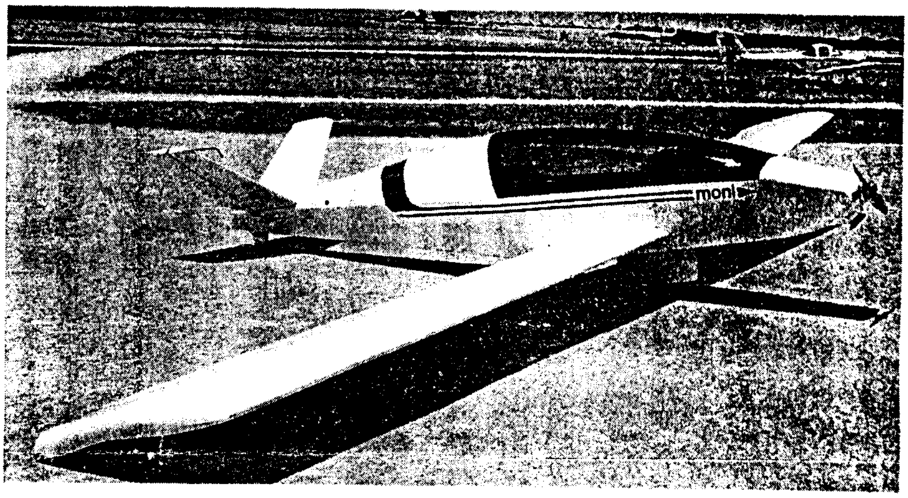
Just have a look in your trailer park. If a pencil has been used to mark the aluminium sheet on a trailer, with a couple of years in the open, we have a deep corrosion pit where the pencil line was previously. Aluminium sheet used on a trailer is usually a relatively pure, corrosion-resisting grade. The effect on a structural dural type alloy in an aircraft is far worse.

Timbers also contain a high proportion of water taken from the air and additionally are slightly acid. Therefore it is necessary to take extra care in the preparation of metal parts in a wooden glider.

The varnishing of wood is not just to protect the timber components from fungus attack. It will also provide an inert barrier against contact with metal parts. All the wood varnishes are equally good and effective, from the old "spar varnish" of natural resin to modern polyester and urethane formulations.

Primers for metals contain chromates for added protection. In the event of a coating failure the chromate compounds react to inhibit the corrosion of steel and aluminium. Zinc chromate gives the paint a yellow-green colour. Another material used in joints is barium chromate which is yellow.

Just how effective these measures can be is proved by the "Golden Eagle" trailer. In 1946 this was covered by a wooden frame to which aircraft alclad sheets were nailed with copper boat nails. Just about the worst combination one could imagine!



However, the wood frame was varnished and each nail was liberally coated with barium chromate compound before asssembly. The 'Golden Eagle' trailer has survived all these years in the open as a consequence.

Before priming the metal it is necessary to clean it. Steel sheet and tube will normally be supplied covered in grease. The excess is cleaned off with petrol before making the part.

After forming, the part is given a quick rub over with emery paper and a final degrease with Mek or acetone before painting. Even better, if the part is welded beforehand any residual oil is burned off the surface. The welder may spray a thin film of lacquer to stop any rusting in the short term but the part is ready for painting.

Aluminium sheet is more difficult to prepare. Under a microscope the surface of aluminium is noticeably porous and contains oil which will prevent the adhesion of the paint film. The oil is used as a lubricant in the rolling or extruding process and is the very devil to remove.

After using a solvent like petrol or Mek to dissolve the excess, best results are achieved by flushing with water to float off the oil. A small amount of detergent should be dissolved in the water to help break the oil down.

Assuming that the oil is totally removed, the aluminium sheet now has a thin film of oxide on the surface. For optimum results this oxide film should be treated, or etched, with a phosphoric acid solution. This is not necessary for internal work and is usually considered outside the capabilities of an amateur but is worth knowing about.

For the MOBA construction I had all the sheet aluminium properly etched and primed before I started to make components. This saved time later and meant that the sheets were matt green, rather than shiny aluminium, which is much easier to work with.

Etching produces a more tenacious bond between the paint and the aluminium, which will be important in service. There is nothing worse than having great areas of paint flake off the outside surface of your glider.

Assuming that the metal surface is prepared, ready for painting, the next step is to slightly warm the metal before priming. Without warming, the metal surfaces will contain small quantities of condensed water which will prevent adhesion. To prepare small parts it is easy to place them on the top of an electric radiator for a short time.

There must be hundreds, if not thousands, of chromate primers available but they fall into four main types.

First there are the quick drying "laquers" of cellulose material, similar to aircraft "dope" used to taughten fabric. This is quick and convenient to use. The most popular method of application is from a small propellant spray pack of so-called "ETCH PRIMER". For big jobs this is too expensive and you need to spray the primer from a normal air compressor spray unit.

The spray is hazardous to use indoors. Apart from being highly inflammable the overspray will do your lungs no end of harm. Painting with a brush gives a poor result.

An alternative for small finished parts is to dip them. Just hang them up to dry on a piece of lockwire.

I would not recommend etch prime for steel parts as the coating is too fragile. However, it is very suitable for aluminium. The primer may be removed readily with a solvent like acetone.

The second group of primers are the true paints or "enamels", which consist of zinc chromate pigment added to a varnish base. These may be sprayed or brushed onto steel or aluminium parts and air harden overnight. They actually oxidise on hardening so are removed with difficulty, using heat or a paint remover.

During the assembly of MOBA I dipped each monel pop rivet into zinc chromate enamel. This was ordinary yellow zinc chromate from the hardware store. I did not use the brown or red "zinc chromate primers" as I suspect these may contain iron oxide.

The next group are the new high molecular weight, two-component, resin primers. These are usually urethane or epoxy resins and are recommended to obtain the best results. They may be brushed or sprayed but I would caution amateurs against spraying. You really need the very best industrial safety equipment, like pressure air masks, to survive with this stuff. However, very good results are possible by brushing and so spray is not necessary for [illegible]

CON'T

The resin primer air-hardens to the touch, by evaporating a solvent, after one day and fully hardens in four days. Removal is only by mechanical means, such as by filing.

I painted most of the steel fittings and aluminium extrusions in MOBA with Stitts epoxy metal primer obtained through Moorabbin Aircraft Spares. This is expensive but just a pint will be sufficient for the control parts of a typical glider. I understand that Dulux supply a similar epoxy primer to the airlines called "Durepon".

Finally we have the barium chromate compounds, such as "Duralac". These gooey pastes come in a tube and are applied between steel and aluminium parts at assembly. They do not harden in the normal sense but form an effective barrier against moisture and corrosion. They are mainly applied to bolts before insertion.

Some steel parts require to be assembled or to run in other parts and consequently a paint film would either be too thick or get scraped off.

Parts which are dismantled on a regular basis, such as a wheel axle, may be coated with grease. Other parts have to be metal-plated for long-term protection.

Metal plating is a specialised process in itself and will be the subject of a future article in this series.

POSSIBLE ADVERSE REACTIONS BETWEEN EPOXY, RESORCINOL AND AEROLITE ADHESIVES

A report from Jerry Schindler, CHEM-TECH Inc, (Manufacturers of T-88)

"Compatibility of glues and adhesives is something that needs to be emphasised, particularly to people who are engaged in repair work."

Table 1. ADHESIVE SHEAR AND TENSION TEST RESULTS

Test No.	Stress, lb/sq in.	Description	Fracture Mode
1	1570	Resorcinol only	Wood tore apart
2	2370	Aerolite only	Wood tore apart
3	2600	T-88 only	Wood tore apart
4	3070	T-88 at 90° to a cured Aerolite joint	Identical to Tests 1, 2 & 3
5	2770	T-88 at 90° to a cured Aerolite joint	Identical to Tests 1 thru 4
6	2520	T-88 joints parallel to 2 resorcinol wood/veneer joints at 90°	Wood tore apart over 95% of interface
7	2820	T-88 joints parallel to 2 Aerolite wood/veneer joints at 90°	Identical to Test 6
8	2820	T-88 joints separated from resorcinol joints by 1.5 mm birch plywood	Plywood sheared apart; resorcinol and T-88 joints intact
9	2730	T-88 separated from Aerolite joints by 1.5 mm birch plywood	Wood of centre piece failed identical to 1 thru 5. One Aerolite wood/plywood joint failed 32% in glue joint and 68% in wood. T-88 joint was intact
10	5830	T-88 w/2 resorcinol wood/plywood joints	Wood tore apart 95% +
11	3680	T-88 w/2 Aerolite wood/plywood joints	Identical to Test 9
12	4340	T-88 only	Identical to Tests 10 and 11
13	4110	T-88 w/Aerolite joint in middle of 1 cross-piece	Wood tore 75%, T-88 25% w/maximum wood failure at the Aerolite joint

* It is not unusual for wooden boats and homebuilt aircraft to be assembled using several different types of adhesives, most commonly epoxy, resorcinol, and urea-formaldehyde (Aerolite).

Under certain circumstances it is possible for epoxy adhesives to be markedly affected by contact with ingredients of other types of adhesives.

Quoting from a recent British publication, "Chiltern Motorgliders advised that the formic acid attacks and weakens epoxy, plastic resin, and casein glues, and a long-standing airworthiness directive in England prohibits the use of formic acid hardeners near such glues."

In order to assess possible adhesive interactions, a series of tests was performed recently by a retired DuPont engineer who is presently constructing a Falco high-performance homebuilt aircraft.

The tests were designed to highlight potential trouble spots and, though test specimen preparation and testing were carefully performed, the gauge of the hydraulic test apparatus was not recently calibrated and slightly different results might have been obtained from research-grade equipment.

Consequently, more emphasis should be given to data trends and relative values than to individual absolute numerical values.

Nevertheless, quantitative data reported here are consistent with data generally regarded as rigorous.

Experimental

Adhesives used were:

(1) epoxy — CHEM-TECH T-88
(2) resorcinol — Weldwood
(3) urea-formaldehyde — Aerolite

Wood specimens were aged, dry, clear white pine, surfaces planed and sanded. Veneer, where used, was aircraft-grade birch. Adhesive preparation and bonding were performed in accordance with manufacturer's recommendations.

Preliminary tests and their results were as follows:

(1) A drop of Aerolite hardener in a freshly made T-88 mixture prevented curing of the T-88. Since the T-88 hardener is alkaline, it is not surprising that the strong formic acid solution would have the observed effect.
(2) An Aerolite joint was made and shortly thereafter an adjacent T-88 joint was made on the same piece. The T-88 joint failed to cure completely in 24 hours at room temperature.
(3) Twenty-four hour soaking of cured T-88 in liquid Aerolite hardener softened the T-88.
(4) Painting liquid Aerolite hardener on fully-cured T-88 joints did not measurably reduce the strength of the joints.

From these results it seemed probable that the greatest likelihood of producing unsatisfactory T-88 joints would occur when one or more of the following conditions pertain:

(1) The epoxy joint is made shortly after an Aerolite joint is prepared on the same piece.
(2) Excess Aerolite hardener was used.

Consequently, thirteen additional samples were made under conditions similar to those typically encountered.

(1) Ambient temperature was maintained at 70°F.
(2) Aerolite and resorcinal joints were cured for at least 24 hours.
(3) T-88 joints were always made after adjacent Aerolite and resorcinol joints.

Test results and observations are shown in Table 1.

Conclusions

(1) The highly acidic (formic acid) Aerolite hardener can inhibit curing of T-88 when intermixed or in close contact.
(2) Cured T-88 will be softened by 24-hour immersion in Aerolite hardener.
(3) Exposure of cured T-88 joints to painted-on Aerolite hardener had no measurable effect on bond strength.
(4) T-88 joints made adjacent to Aerolite or resorcinol joints which had cured for 24 hours or more at 70°F were not adversely affected, i.e., T-88 in all cases produced wood-tearing joints in both tension and shear.

Summary

Epoxy adhesives, whether uncured or fully cured, may be adversely affected by the formic acid constituent of Aerolite hardener and, to a lesser degree by the acidic resorcinol adhesive.

Tests performed on a CHEM-TECH T-88 epoxy adhesive indicated that it is acceptable for use in conjunction with Aerolite and resorcinol provided that these adhesives have fully cured. Similarly, normal use of Aerolite and resorcinol do not interfere with previously-cured T-88.

These considerations should apply to other brands of epoxy adhesives as well, however, the user should satisfy himself regarding the suitability of any other epoxy adhesive, particularly in critical structural applications.

WELDED JOINTS

HAMMER & SOAR
by Gary Sunderland

Most designers and builders are these days well aware of the need to avoid or reduce stress concentrations. By tapering the ends of structural elements the local stress under load should not be significantly more than the average stress in a structural component.

In wood spars for example the spar booms are carefully tapered and blocks inside the spars feature "birdsmouth" or "frogsmouth" ends, purely to avoid the effect of a change in stiffness which could result in a local failure. The familiar tapered root spar connection on a fibreglass glider is another good example.

Unfortunately all this common understanding and practice seems to be forgotten when it comes to welded steel components such as control rods and undercarriage parts. In the short term this is no problem where the average stress is low but long term servcice under repeated loads can lead to metal fatigue and failure during the life of the glider.

The problem is not confined to homebuilt sailplanes but unfortunately even the latest "mega-buck" glass jobs seem to have more than their reasonable share of poorly designed metal parts which seem to be "designed in" to the structure on the "quick and nasty" principle.

As amateur builders, our sailplanes may not necessarily accumulate flight hours as fast as a factory-built club glider but this is no reason to adopt bad practices. Your sailplane hopefully will be flying for many years to come and be owned by a succession of private individuals. So provide them with only the best workmanship.

Figure 1 shows a welded butt joint in the elevator push-rod of a repaired sailplane. The maximum stresses in the weld were actually quite low, about 10,000 psi, but under repeated load cycles a crack had started which progressed through about half of the connecting tube. The part did not actually fail in service but was discovered when the glider experienced a ground loop tail break about five years later.

The weld metal used in sailplanes is usually (not always) a low carbon "mild" steel deposited as a liquid metal by an inert gas flame. When the weld metal cools the grain structure and properties are virtually those of a steel casting. This is greatly inferior to the strength of the original steel plate or tube.

The original material, even if it is "mild" steel, has a refined structure largely free from defects and the grain structure has been elongated by a certain amount of cold working during the final finishing operations.

Sometimes it is found that a welded part will crack, not in the weld but immediately adjacent to it. This is because the weld joint and the refining of the adjacent grain structure in the metal part during welding. This can happen even if the metal is not overheated.

Figure 2A shows how this stress concentration effect can be reduced in a plain joint in a metal tube. The usual method is to drill a number of holes in the outside tube and weld "rosettes" or slugs of weld into these holes.

Where space permits an alternative method is to add external tapered patches to the joint, as shown by Figure 2B. This scheme conforms generally the practices recommended in FAA Publication AC43-13 Figure 2-8. While this example relates to repair methods a similar situation relates to tube joints to end fittings.

Figure 3A shows a steel tube welded to a pushrod end. Figure 3B shows how simply the welding can be improved to give increased durability and fatigue resistance.

It is particularly important to reinforce control joints which transmit torsion. For this we need a "finger plate" of flat steel bent around the joint and welded.

Not all tube assemblies need to be reinforced. For example the rudder pedal assembly shown at Figure 4 does not transmit torsion loads, the load is transmitted direct to the rudder cable. However on other designs the torque load is transmitted via bending at the joint and consequently the joint should be reinforced as at Figure 5. For further information see the FAA Publication AC43.13 Chapter 2 relating to weld repairs.

Note well that the welder **must** be a person experienced in aircraft welding and appropriately authorised. Refer to the GFA Manual of Standard Procedures Section Air 45.4.2

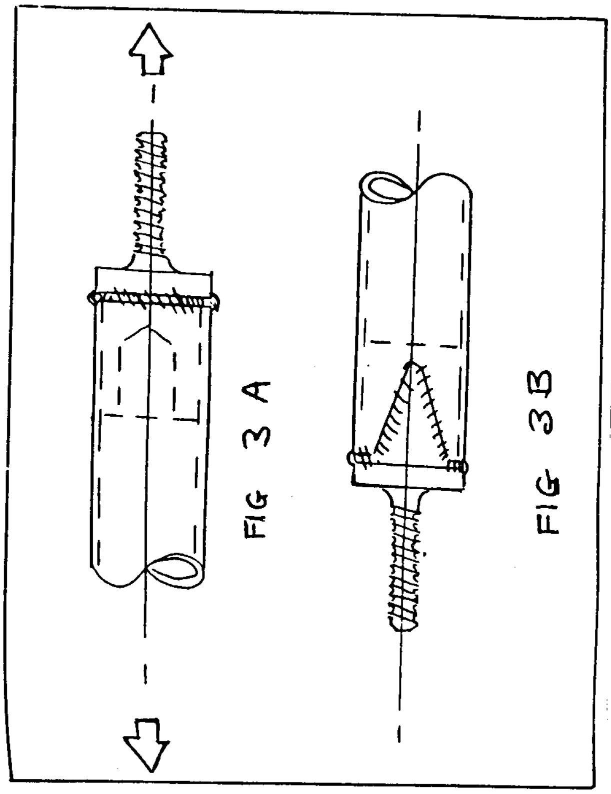


FIG 3A FIG 3B

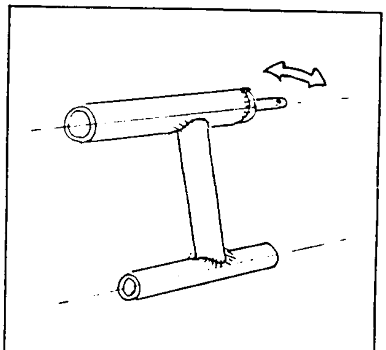


FIG 4

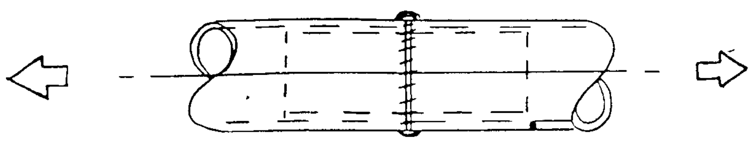


FIG. 1

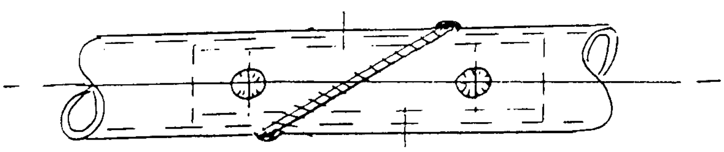


FIG. 2 A

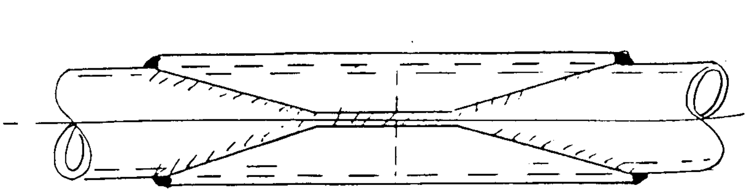


FIG 2B

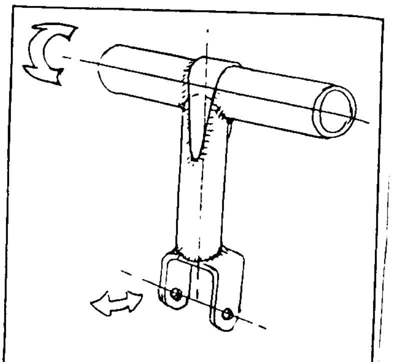


FIG 5

HINTS ON STEEL PARTS

Sailplanes for home-building are designed so that mostly simple procedures like cutting, drilling, gluing, etc., are required for assembly.

An exception to this rule are steel fittings which usually require processes such as welding and possibly heat treatment and plating. For technical information on these processes refer to publications like the FAA Advisory Circular 43.13 and "Well's Manual of Aircraft Materials and Manufacturing Processes." Similar texts may be in your local library. This article will be concerned with practical aspects of organising the work.

Although it is possible for a builder to become suitably trained and to carry out all the welding, usually this work is farmed out to a specialist. Most projects have only a few steel parts and very little welding so it is usually not worth the bother of the builder becoming proficient in this particular skill.

However if the design has a steel truss framework to be prepared for welding the builder should at least read the EAA Aircraft File number 2 "Welding" which has some good tips on jigging and aligning parts.

The first step will be to contact your local aircraft welder and discuss the project with him. Every major general aviation Airport has at least one person holding a DOT Welding Authority. Take your plans and clarify what is required in the way of jigs to hold the parts for welding. Under no circumstances should you tack weld the parts together without first obtaining prior agreement from your welder. He will probably want to see a few test samples of your handiwork before agreeing to any tack welding. Do not argue if he condemns your efforts. He is only saving you money in the long run. After the work is done be sure to obtain a receipt for each job when you pay for it. This receipt should identify clearly the parts which were welded and the authority number of the welder. This evidence will be required when you request a Permit to Fly or a Certificate of Airworthiness.

Your RTO/A or local builders will be able to recommend a welder. For a glider built completely with the GFA system you may obtain the services of a welder holding a GFA Authority as an alternative to a DOT welder.

You should have no problems with the quality of the work. Aircraft welders are highly skilled and would not remain in business long with a bad reputation. Such few problems as have occurred are usually the fault of the individual builder. Faulty preparation due to inaccurate jigs, badly fitted parts and unauthorised tack welding will get knocked back so be forewarned.

There have been the odd occasions when a few lumpy looking welds have mysteriously "appeared" on jobs after the event. In this case your paperwork will not fool the inspector and your welder will get very angry when he gets dragged over to "please explain." So if you have any subsequent additions to make be sure that they are as good and as legal as the rest. If you want to play at welding without an authority please confine your activities to the trailer.

From your plans you will observe that most of the steel parts remain in the as welded or "normalised" condition. In fact many of the parts may be from plain low carbon "mild" steel because they are designed for stiffness, rather than strength.

There are a few exceptions in the way of highly loaded steel parts which require to be heat treated to increase their tensile strength. Usually only wing attach fittings and some undercarriage parts.

Heat treatment is a process requiring special temperature controlled ovens and oil quenching baths and unfortunately only large organisations like the major airlines and aircraft manufacturers have the sort of equipment required. The process of dealing with any large organisation is a problem for an individual and it is very easy to get "lost" in the system. Thus a few words of advice may be in order.

First step, as usual, is to make some sort of personal contact. These large firms have a sales person to look after small orders. Call to see them or at least ring before you write. Make sure they know who you are and what you want. Get their name and extension for further enquiries. This contact is well worth a trunk call if you live in a remote area.

Next write the organisation a letter, marked to the attention of the sales contact, in the form of an order.

For example: —

"To XYZ Airline,
Attention J. Blow,"
"Please heat treat glider wing fittings supplied,
4130 Steel to 125,000 p.s.i. tensile.
(signed) A. Amateur
Box 4, Woop, Woop.

Do not be too clever. I once ordered heat treatings to the appropriate U.S. Military Specification. After some lack of progress I queried the delay and found that the particular aircraft factory involved had their own "in house" specifications for heat treatment and it was a major exercise for them to qualify the process to another specification, although the final result was identical.

At the same time that you post the letter you need to send your bits. These parts should be in a box, clearly addressed to the firm and marked also with your name and address. Even if your bits are small it pays to pack them in a reasonable size of box for transit. These organisations will receive all incoming parts into a store and the storeman will do his level best to lose them so it is wise to make the packaging as noticeable as possible.

Inside will be your parts wired together with an identifying tag and a copy of your letter. The identifying tag should be robust and preferably metal to withstand being handled from one department to another.

This may seem a lot of trouble to take but it sure beats having to start all over making new parts. I have been there!

Just getting a simple job done may take a lot of time so make sure to plan ahead. In fact for all sorts of good reasons it is recommended that the glider's steel fittings should be the very first things that are manufactued. That way you will not be held up subsequently.

Large aircraft firms normally supply outgoing goods with a Release Note. This certifies to the work carried out and will ease the task of clearing your glider for flight when the time comes. However getting a Release Note sometimes involves incredible delays and expense, depending on the firm, so it pays to check. In one case my fittings cost $50 to heat treat and it would have cost twice as much for the Release Note, plus a delay of over a month.

Evidently the organisation's inspection department would calibrate their ovens and other equipment every month or so as part of production controls for the issue of Release Notes. In the event I accepted the bits with just a receipt and carried out a hardiness check at the local Technical School as an alternative means of quality control.

After welding and/or heat treatment you may want to metal plate the steel fittings. Such a step needs to be considered very carefully.

Welded metal fittings are laminated from thin steel sheet and tube. Unless the edges are welded all around the part may not be suitable for plating. Remember that the object of the plating is to prevent corrosion, not just to make the part look pretty. If the construction is such that liquid can penetrate between layers of steel then internal corrosion will occur after plating.

The liquid used in metal cleaning and plating baths is highly corrosive and must be flushed from the part after plating. In past years the liquid used in a cadmium plating bath was invariably sodium cyanide. However in recent times the problems of cyanide disposal have led to the development of other liquids which are acid and can be even more corrosive if not removed completely.

Therefore if there is the possibility that liquid can get into the part and not be positively flushed off afterwards, then the part should not be plated but painted in accordance with the recommendations of a previous article in this series.

Open steel tubes can of course be flushed out afterwards. If the part is a "blind" steel tube then the other end can be stopped with a cork and completely sealed with epoxy before plating.

Cadmium plating gives the best results and protection to steel fittings, although an industrial hard chromium can be used

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on parts subject to wear but not too much flexing. Hard chrome is used on some aircraft telescopic undercarriage legs and I used hard chrome on the MOBA control levers, which operate by sliding in plastic bearings.

If you get your plating done by an aircraft organisation you may be assured that after plating the parts will be thoroughly cleaned by boiling in water and subsequently heated in an oven to remove hydrogen embrittlement.

The electro-plating process causes hydrogen to combine with the steel and can lead to cracking and brittle failure in parts subject to flexure, particularly in springs. It is relieved by baking the parts for a day in an air oven at 150° to 200°C. Normal glider fittings will not be affected sufficiently to cause any concern but heavily loaded parts which have been plated after heat treating should be baked to relieve hydrogen embrittlement.

If you get the job done by a large aircraft factory or airline you will need to go through the usual rigmarole. Alternatively you can use the services of your local plating works but you will have to subsequently clean and bake the parts yourself.