THE AUSTRALIAN HOMEBUILT SAILPLANE

Editors: James Garay / Peter Champness

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Editorial

Merry Christmas & best wishes for a happy and prosperous New Year!

James Garay &Peter Champness
Editors

G'DAY MATE!

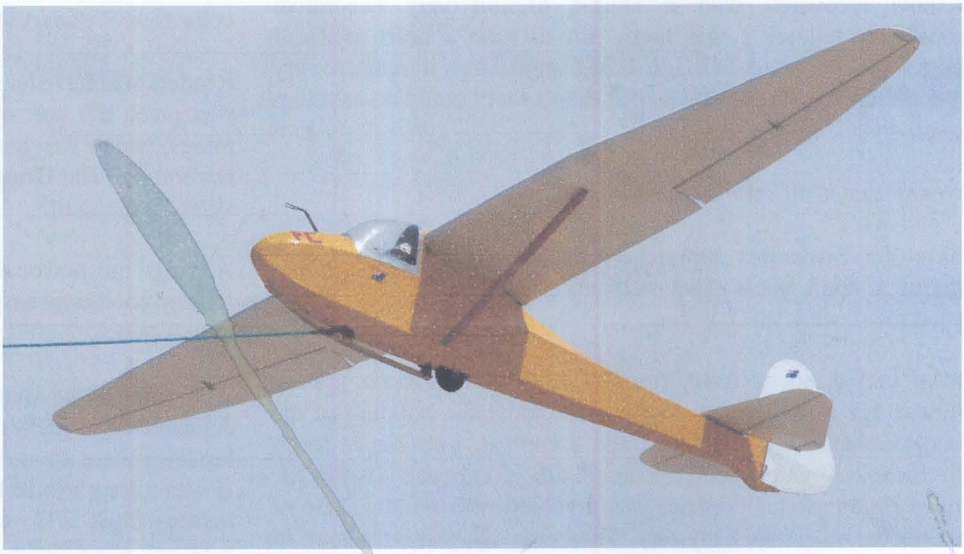
This is our Christmas Issue for the year 2005 and it is prepared by our team that have been working very hard to give you some topics of your interest to read.

It is my duty to thank you for your unconditional support and we hope that the next year will be even better

Keep those letters coming with your articles; we are here to share knowledge and expertise!

We are proud to have a new member in our group, he is very well known as a pioneer of Gliding in Australia and his name is: ***Geoff Richardson****.*
On behalf of all "AHS" members.

Welcome aboard Geoff!



Geoff Richardson's Golden Eagle owned by Claude A. Patching.

Address all correspondence to:

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Inside This Issue

Dear James,

Referring to last month issue, there is some interesting articles in the Smithsonian Air and Space magazine. May/June, quite extensive comments referring to micro lift and the Carbon Dragon, all of us will find quite interesting. When I return home I'll copy it from the magazine and forward it to you.

Enclosed is payment for this year subscription, I'm sorry about the late payment. I have been busy with work. Being a seafarer time can get away. Keep the good work! Great! newsletter. I always look forward to receive it. Regards! Allan Edwards.

Dear James,

As I mentioned before, I have abandoned the idea to build the Woodstock, the total cost for copying the plans from the disc was $ 115,00, now I want to sell them.

As you have some advertising in the Newsletter, will I have the chance to find somebody who wants to buy them?

With all my thanks in anticipation, yours faithfully.
Rene Jollin. *Eds note: See Classifieds section.*

Dear James,

Hello again I don't know if I told you already but after my three months in England trying to reorganize myself after Jean's death. I returned late in July to discover, after a check, that I urgently needed a triple bypass operation, which took place in August 15th. I am now recovered with a couple of not very decorative tattoos)They tell me I was lucky not to have a heart attack. I guessed already two years ago I had angina but it seemed very slight and all the time Jean was ill I didn't feel I could do anything about it.

Any way, that is all behind me now!

I have the September newsletter, which is full of interesting material. I don't know what state my subscription is in. Please remind me if and when it is due.

I have had a query from Francis Humblet, a French gliding archivist. He would like to know more about the building of the Woodstock and Dusters in Australia. I confess. I am out of touch with this myself and I thought I should ask you about it. I know the famous Erudite Peter Raphael was involved with building one of them but the others are a mystery. There was a Duster written off in an accident some years ago. I recall, and I saw a Woodstock at Stonefield myself but I have been told it is not yours after all.

So, can you give me a run down on how many of each, Duster and Woodstock, there are in this country, who built them, and where they are now? I hope this is not too much bother for you but I would be very glad to have the information.

I trust you are well. All the best. Martin Simons.

BORDERTOWN 2006
VGA Annual Rally
7-15th January 2006

Again as previous years we are joining our cousins Vintage Gliders Australia for a Summer Camp. It will be in Bordertown South Australia.

Recent contact with the Bordertown Keith Gliding Club has confirmed that preparations are in full swing for this Summer's annual rally. Some building work on the Club House should make some more space in the kitchen and bar area, and club members are looking forward to the event. Keith Nolan will be offering a wooden aircraft repair course during the rally. We are hoping for some new participants this year after the great time had by all last year. We look forward to seeing all those who can make it.

A NON GLIDING TRIP OVERSEAS

By Claude A. Patching

My wife- Lorna- agreed to come overseas to the **IVSM 2005 (International Soaring Meeting)** providing that was the only gliding, and would be followed by a journey to England to visit her cousins. As a result I only visited five gliding sites, four aviation museums, made three glider flights and one Aeroplane flight!!! However we did drive 2600 miles around England visiting friends and relatives.

We first went to Tehachapi where both John Ashford and myself have been given great hospitality, and we had a car to see the wind turbines, the whole 5000!! Of course I showed Lorna Jeff Byard's collection of gliders at the gliderport.

Readers will have learnt all about the IVSM from Vintage Times. I was given the task of chairing the judging committee for all the prizes, which was not an easy task to do because of the excellent restoration. The flying weather was great an on one day 14 gliders shared a thermal!!

Amongs the personalities present were Bill Schweizer and Jack Laister so it was easy to keep occupied even though we did not have a glider.

After Elmira we went to Dallas and stayed with Dick and Alice Johnson who took us to the Texas Soaring Association field, however there are no homebuilt gliders at this relatively new site.
It was a long trip to England via Chicago-no recommended. After visiting Chris Wills who showed a DVD of the recent Rally where a Mucha attempted to take off with the main wing pin not properly in place- fortunately the pilot noticed the increased in dihedral and aborted the launch!

We visited the Army Aviation Museum at Middle Wallop where there is an excellent collection about the use of gliders ranging from Kite-1 to a Hadrian and a Horsa. Films of actual landings in Normanby were most interesting. On our visit to Nympsfield to discuss the K-7 failure I met up again with Gavin Wrigley who spends his time between the Darwin and Bristol gliding clubs, He convinced me to have a launch with the SupaCat which in their

Astir Acro-impresive angle of climb!!, While at Lasham I talked wlth the Vintage group who are now quite active restoring and inspecting older gliders. Everyone is now aware of the need to keep all gliders in a dry environment and so far casein and resorcinol glues have been found to have kept their strength. The K-7 failure can be attributed to poor storage and maintenance. The BGA have introduced 5 yearly inspections similar to the GFA Surveys.

I did not come across any home building in our travel but at Glen Curtis Museum in Hammondsport, USA, they are building wooden replica aeroplanes and have the most magnificent collection of wood working tools that I ever seen.

Our flight from London to Singapore was in the rear seats of a 747 which randomly oscillated from side to side for all except the last hour of the flight.

Overall a very pleasant journey with a reasonable amount of flying but it was great to get home where there are so few people and cars.

From the Newspapers

By Peter Champness

The following two articles caught my attention. I have been a model aeroplane enthusiast since childhood, although I have only completed a relatively few models. Recently I have become interested in electric powered model aeroplanes. The rechargeable Nickel Cadmium battery and the slightly more powerful Nickel Metal Hydride battery have made electric powered model aircraft a practical reality.

The commercial imperative for these batteries was the portable power tool (electric drills etc) which are sold in the millions world wide. Portable power tools required a lot of energy in reasonably light package. The nickel cadmium battery was able to provide the required power and the huge market encouraged and paid for the development and commercialization costs. The model aeroplane hobby was the beneficiary.

Very recently the introduction of the much more powerful and light Lithium Battery has begun to transform the hobby. I recently purchased one of these batteries and I have been very impressed by the power and light weight. I bought a 4000mAh battery which is made up of 3 cells. Each Lithium cell produces a 3.4 volts. The Lithium battery therefore gives 4 amp hours at 11.2 volts but weighs less than a 1600mAh 8.4 volt nickel cadmium battery of 7 cells. That is more than 3 times the power for less weight. It can put out a sustained current of 40 amps!

Lithium Batteries still have their problems. My battery came with a very explicit warning that it had **No Guarantee** except that it was OK when it left the factory. Lithium batteries have a reputation for melting, catching on fire or exploding; particularly if the maximum current is exceeded which is very easy to do if a short circuit develops. So far however I have run the battery a number of times and it barely even gets warm at currents that would have made the nickel cadmium battery quite hot.

The following articles suggest that even more exciting and impressive developments are just around the corner.

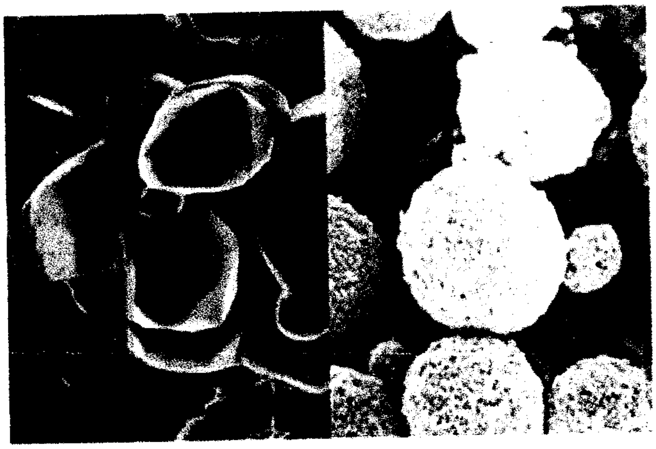
Batteries in Power Play

By Duncan Graham-Rowe

The Age March 22, 2005
Reprinted from New Scientist

Electrode upgrade

Scanning electron micrographs show the difference between the surfaces of two types of electrode. Altair's new anode should allow even small batteries to supply bursts of power when needed.



In a standard lithium-ion battery, the carbon anode has a smooth surface, limiting the rate at which charge can be exchanged with the cathode.

An anode made from grainy lithium titanate nanocrystals has more than 30 times the surface area, making faster discharge and recharging possible.

A rechargeable battery that can be fully charged in just six minutes, lasts 10 times as long as today's rechargeables and can provide bursts of electricity up to three times more powerful is showing promise in a US lab.

New types of battery are badly needed. Nokia's chief technologist Yrjo Neuvo warned last year that batteries are failing to keep up with the demands of the increasingly energy-draining features being crammed into mobile devices.

The highest energy-to-weight ratio in today's batteries is provided by lithium-ion (Li-ion) batteries. They are also cheaper in terms of energy delivered per unit of weight than other types such as nickel-metal-hydride (NiMH) and nickel-cadmium (Ni-Cd) types.
But Li-ion cells have their drawbacks, too. They eventually wear out and they cannot discharge energy quickly enough for applications requiring power surges, such as camera flashes and power tools.

This could soon change, however. Altair Technologies in Reno, Nevada, has created a new type of Li-ion cell in which the anode (the positive pole of a battery) has an exceptionally high surface area. This allows electrons to enter and leave it quickly, making fast recharging possible and providing high currents when needed.

Li-ion batteries work by forcing lithium ions from a lithium cobalt oxide cathode to migrate to a carbon anode via an electrolyte solution. Altair's patented modification is to make the anode surface out of lithium titanate nanocrystals, using chemical tricks to give it a surface area of about 100 square metres per gram, compared with three square metres per gram for carbon.

The company is keeping the chemistry that allows it to do this a secret for commercial reasons. But its patent reveals that the increased surface area is achieved using a carefully controlled sequence of evaporative steps when making the lithium titanate crystals.

The high current that this modified electrode is able to carry means power-hungry devices can be installed in mobile phones. For instance, camera phones might now have enough power to run a flash.

Altair says the battery will have other advantages. The crystalline surface of a carbon anode is susceptible to damage by the repeated temperature changes that occur as the battery is used and recharged. This limits its life to about 400 charging cycles. The more rugged lithium titanate anode should make it possible to recharge the battery as many as 20,000 times, says Roy Graham, development director at Altair.

A longer lifespan should also be better for the environment, he says. "The continual use of polluting cobalt oxides is questionable."

Altair plans to develop its batteries for power tools, which have until now required more expensive Ni-Cd or NiMH batteries to provide the large currents required. The company hopes to license its technology to battery-makers, which could have products on the market in two years.

Altair says it wants to produce batteries for a for a broad range of devices, from phones to hybrid electric vehicles.
New Scientist

MIEV's Quiet Revolution

By Bryan Littlely

Herald Sun, Friday Oct 7, 2005
A whisper quiet green car which produces no emissions and can be fuelled in your own garage is more than just a dream for Mitsubishi.

It has developed a vehicle with plenty of futuristic advantages, thanks to motor in wheel power and breakthrough battery technology.

Mitsubishi Motors began working on the lithium-ion battery technology to power its in-wheel motors because other manufacturers believed improving battery performance was out of the question.

While others looked to hydrogen powered fuel cells and petrol electric hybrids in the race to produce more efficient vehicles, Mitsubishi drew on the expertise of its parent company – which has a hand in everything from rocket technologies to chicken farming – to develop better battery packs and the in-wheel motor.

The result is MIEV, which is expected to hit the road in Japan by 2010.

Battery pack improvements have not only taken the driving range of the MIEV experimental vehicle to 150 km, it also means in-car space has been freed up considerably.

The small in-wheel motors, capable of producing 50kW (20 kW on the demonstration vehicle), and considerable torque, also clear the decks and give greater design freedom.

By 2010, Mitsubishi predicts the driving range of its motor in-wheel vehicles to be up to 240 km while the charge time for the battery pack should be halved from 20 to 10 minutes.

Mitsubishi engineer Tetsuro Aikawa, involved in the design of the third generation Magna 10 years ago, says MIEV is the carmakers base platform for environmental technology.

"The advantages to MIEV over efficiencies are that it gives great freedom to design layout and drive torque and braking force can be controlled with high precision," Aikawa says. Remaining problems include handling and ride comfort.

The new battery technology promises to make electric cars a practical reality in the same way that nickel cadmium batteries made portable electric power tools possible. If this happens, and the current oil price rises make it much more likely than not that it will, encouraged also by concerns about global warming, then the huge market for electric cars will pay for the development and commercialization of the new battery technology. The self launching glider may well be the beneficiary. The power required for even a modest sized electric car should be more than enough to launch a single seat glider, maybe even a two seater.

The motor in-wheel technology that Mitsubishi is working on may also give rise to a plentiful supply of light weight and powerful electric motors. If the electric motor is to be mounted inside the wheel it must be both small and light. Assuming that the proposed 50 kW is provided by two driving motors then a single motor would produce 25kW which should be sufficiently powerful. Raising a 500 kg glider at one metre per second (1.8 kts) requires 5 kW. Assuming 50% propellor efficiency and allowing for aerodynamic drag etc a 25kW motor could produce a climb rate of 3kts (300 ft per second) which exceeds the requirements. A small glider like a Woodstock would probably climb at twice that rate.

The disappointment is that Mitsubishi does not expect the car to be ready for commercial release until 2010. Maybe the pressure of competition and high oil prices will cause that date to be brought forward. I would really like to see that.

The Corby Starlet lives on

By Norm Edmunds - SAAA Chapter 20 Kyneton District

(Eds note: As I said before not long ago Norm Edmunds gave us a lecturer on "Experimental category" at our last Symposium. Then he was building his aircraft .Now it is finished. Here is his story, it is not related to gliding, but is a pleasant reading and the aircraft all wood is a beauty)
Easter 1997 I discovered the Corby Starlet. Now, I'm flying one, (code named "Red Alert") and yes, I built it myself, but not from a prefab kit costing megabucks like other varieties. You see, there is no kit for the Starlet – it's a plans built aircraft, hand crafted piece by piece from timber and plywood. And yes, plenty of people still do that, and are still doing that with the Starlet, which is approaching forty years in service in Australia and overseas.

Designed by Australian aeronautical engineer John Corby in the early 60's, the Corby Starlet is a single seat amateur built aeroplane, capable of long cross country flights and aerobatics as well. Guess I'll have to get an aerobatic endorsement…

So how do you get to own and fly a thoroughbred like this then? First, you get on the phone to John in Sydney and order a set of his plans. Next, you study them day and night, night and day. When you can recite the measurements and specs of each piece you are ready to begin! Get hold of some good quality aircraft timber (that's the challenging part these days) Choices are few, I built mine from QLD Hoop Pine but many builders still prefer to use some imported stuff called "spruce" (more commonly used in ladders) My aircraft is proudly Aussie designed, built using Aussie timbers and ply, and powered with an Aussie engine.

The Airframe: So you get to work, making jigs for the tail feather ribs. Most builders make these first as they are quite easy and if you should mess it up, easy enough to re-do. If you can build these neatly, you can build a whole Starlet. Soon the tail feathers all take shape, tailplane, elevators fin and rudder. All there is left to do is make some wings and a fuselage! (yeah…right…) Wing ribs get made piece by piece, from plans you draw up yourself from a table of coordinates on the plans. As the ribs are somewhat critical in shape, the plans copying process would distort them too much so this is the reason why full-size drawings are not provided. You'll need to build or acquire some wing rib jigs.

Metal fittings: These aren't too difficult to build, but you will probably need assistance with some machined items and the welding. Fortunately, under Experimental, we do not have to have 'release notes' for welding done now, so you can do it yourself or have it done by an experienced Tig welder. You can't yet buy a complete set of metal parts for a Starlet from one source but you can buy some parts such as the control stick assembly and the fuel tank. The standard sliding canopy set comes from a company in New Zealand who also make fibreglass wingtips, spats and tailplane & elevator tips. Their fibreglass work is second to none. A locally made "One Design" canopy also fits nicely. The spring steel main U/C legs are a bit tricky to cut out. (I'm contemplating having another batch water-jet cut.)

Covering and painting: My advice is to do it all yourself. I did, (as was advised to me by an expert covering tradesman) and the satisfaction of being able to say "yep, I did it all myself" is just the best. I used the Polyfiber system throughout, followed the book and the video to the letter and the results speak for themselves. It is foolproof. I have a totally professional looking covering and paint job complete with full rib lacing. I strongly advise that you <u>do not</u> get an experienced spray painter in to do the spraying. Polyfiber solutions aren't "paint" as such, and the required technique is not anything like normal spray painting. So please don't employ an expert painter to come in and ruin your aeroplane. Read the book then paint it yourself. Trust me, I work for the government.

Engines: Many aircraft are now being fitted out with the Jabiru 2200 85hp engine and the Jabiru supplied firewall forward package for the Starlet. Generally, there is still a lot to do to get all these items to fit in harmony, but the end result is a winner. There are still some aircraft being completed with VW conversions using Armstrong starters, which are largely trouble free.

Help: Being an active SAAA member, I always had plenty of guys that I could call upon for advice or helping hands. I didn't have just one inspector checking my work, I had everybody checking my work!

Paperwork: Aircraft had to be registered with CASA, and I got my desired rego too. The cost? Nuthin. Also needed a Noise Exemption Certificate from Airservices. The cost? Nuthin. SAAA members handle the final inspection – CASA doesn't get directly involved. The cost? Nuthin. I never once entertained the idea of registering it as an ultralight as I need the ability to go into controlled airspace once in a while which G.A. can do.

Final Assembly: Out at the airfield and fully assembled, it's time to start getting serious. You'll need to carry out a thorough final inspection, preferably with someone who has done a few. Fortunately for me, my co-owner of the hangar Colin has done plenty of glider inspections, so all went well – just one or two small items to attend to. Then it was ready to have it's Experimental Certificate issued after the official final inspection by a CASA endorsed SAAA Authorised Person.

Test flying: Although I had a tailwheel endorsement, I spent a few hours with an instructor in a Citabria getting comfortable. Unfortunately, the Citabria is nothing like a Starlet on the ground! But it was a necessary and useful training session regardless. Then I spent numerous days and 3.5 hours total time taxying up and down the runway and testing engine performance. The Starlet is one agile critter on the ground. They say that to fly tailwheel, you have to get your feet working. Well, to fly a Starlet, you have to <u>stop</u> your feet working! Eventually, I managed, so then came the question… should I fly it myself, or do I get the velvet flying hands of Aub Coote from Geelong to hop in it? My only real concern about letting Aub fly it was that he might not come back! (He loves flying Starlets!)

Well on Monday 18th July 2005, conditions were perfect, I had gone over a thorough flight plan with my two assistants Colin and Frank (both Starlet builders and high time tailwheel pilots) so it was off into the wild blue yonder over Kyneton for a 50 minute flawless first flight. It all went exactly to plan and the landing was probably the best I've ever done.

How does it fly then? Fantastic! John Corby got it right on the money first go. So far in early testing, it likes to cruise at 105-110 knots at 2800rpm, and climbs comfortably at 1100fpm, but it will do 1500 if required, and I fully expect these to increase when the engine comes alive at about 90 hours as I know they do. Take off run is about 200 metres without trying too hard and landing into 10kt headwind uses about 350m at the moment. These will decrease with experience no doubt. It stalls with no wing drop at all at 34 knots, so I approach at 50, with 45 over the fence. There's very little nose drop at the stall – it's really a non-event. Visibility from the office is panoramic and the handling is crisp and delightful. It is absolutely "normal" to fly – anyone could handle it (not <u>mine</u> though! Nick off!)

I would like to name and thank a few Starlet drivers that I was able to squeeze for flying tips: Aub Coote, Brian Turner, Hans Litjens, Ken Hess, Stephen Graham, Scott Jarron and Russell Garroway, plus Mike Cuy and Bernardo Melendez in the United States. We Corby Starlet types are planning a mass invasion at the SAAA convention next year in 2006, for "Forty Years of the Corby Starlet" celebrations. We will be seeking as many Starlets as possible to attend. This year (end of October) we hope to have 6-10 Starlets at SAAA/Wagga Aero Club "Wings over Wagga".

Watch out for "Red Alert" sneaking up on your six.

Merry Christmas & best wishes for a happy and prosperous New Year!

Hooking Up With An Old Member

By The Erudite

I spoke to Paul Dalziel the other day on matters relating to his Woodstock. Paul lives in Queensland, is a former member of AHS and had attended our first regatta at Bendigo in 1997 as well as a Homebuilders Symposium at Smithfield, Nagambie held in November 1998.

Paul also happens to be the owner of VH-HDH, the first Woodstock completed and flown in Australia. Paul purchased this aircraft from Les Squires along with another of his creations, the Jodel, an amateur aeroplane design.

I contacted Paul as I was trying to locate copies of drawing that I knew existed at one time in relation to the winch release that was originally installed in this aircraft. My efforts to locate copies through official channels were fruitless and as it transpired Paul no longer had his either.

Paul indicated that he had not flown for some time due to health issues and was currently endeavoring to get his weight and health under control in order to pass his medical. Discussion turned to the handling of the Woodstock on the winch and I was surprised to learn that Paul had not yet flown the glider. I believe that his attentions turned to power flying some years ago, moving the homebuilt sailplane scene into the background.

We had a long discussion on the state of the homebuilt sailplane movement as it is now and the progress of past and current projects. I was also able to convey my appraisal of the Woodstock handling characteristics in the hope that Paul will be inspired.

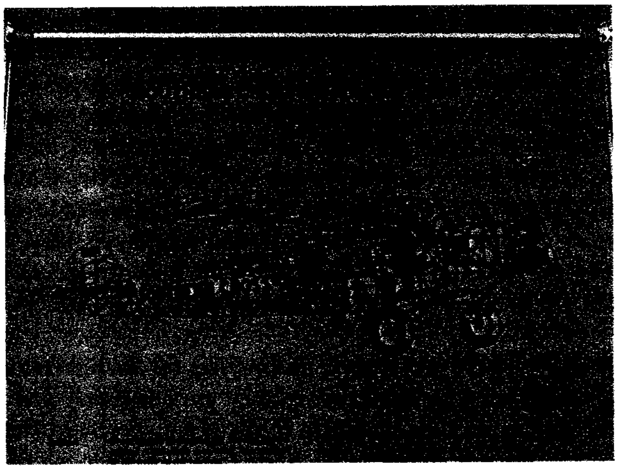
Anyway, to help with my enquiries Paul went to the trouble of disassembling his glider and has kindly sent me some images of his release installation, and this will help me with my own conversion. I sincerely hope that Paul gets the opportunity to fly his glider in the not too distant future.

A Visit to the Kingsford Smith Memorial Brisbane Airport

Peter Champness

When I pass an Aeronautical exhibit or memorial I try to pay a visit if time allows. The Kingsford Smith Memorial is located on the Brisbane Airport Drive opposite to the International Terminal. Within a hangar sized glass enclosure resides a full sized replica of the "The Southern Cross", a Fokker Trimotor aircraft used by Sir Charles Kingsford Smith and his crew, Charles Ulm (co pilot) and two Americans James Warner and Captain Harry Lyon, acting as Navigator, Engineer and Radio Operator, on the record first aerial crossing of Pacific Ocean in 1928.

Merry Christmas & best wishes for a happy and prosperous New Year!



On previous visits I have been the only visitor but on this occasion the car park was almost full with almost twenty cars present. Perhaps it was the time of day or maybe the Nation's aviation heritage is becoming more popular with the public.

The exhibit is placed within a small a secluded park, virtually invisible from the main airport drive although it is only a few metres away. The hangar is almost concealed by a large mound of earth which is well grassed and covered with shrubs. The mound resembles a defensive earthwork from some angles and perhaps it is supposed to evoke the redoubts defending aircraft on military airfields. A second mound obscures the view from the road to the domestic terminal.

The hangar is quite an interesting construction, consisting of a single arched roof of corrugated iron supported by 5 large curved 'I' beams. The beams bear on a sloped concrete and earth buttress on each side. The building is architecturally attractive and has design similarities to an arch bridge. It also evokes the large hangar structures seen at airports (the hangars at Avalon Airfield especially) and also the World War II era Quonset hut.

Within the hangar is a rectangular enclosure with glass curtain walls about twenty feet high, within which resides the Southern Cross. The hangar is large enough to house a substantial pedestrian walkway, outside the glass enclosure and open to the breezes but protected from the rain. Around the edge of the glass enclosure are a set of poster displays with pictures of the Southern Cross in the late 1920s and early thirties and historical information about Charles Kingsford Smith, his crew and some of their record setting exploits.

The Southern Cross set of on its pacific flight in 1928, leaving from Oakland California to Hawaii, then Hawaii to Suva (Fiji) and then Suva to Brisbane. Their arrival must have been well anticipated because a huge crowd of 25,000 people turned out to welcome them at the Eagle Farm Airfield in Brisbane. The Next day they flew to Sydney and were greeted by an even greater crowd of 300,000.

The flight was not perhaps quite as risky as the Charles Lindberg trans Atlantic crossing in the 'Spirit of St Louis' because the Southern Cross had three engines and sufficient crew to allow some rest during the flights. They were however lucky to make it because the Pacific Ocean is so large and the Island landing places are mere specks in the Ocean, so easy to miss especially in bad weather. Many aviators of the period were lost at sea, including in the end Kingsford Smith himself, Charles Ulm and the famous aviatrix Amelia Aerheart.

The Southern Cross is the only aircraft in the exhibit although two large scale models are also included, each about 4 ft (1.5m) span depicting an Avro Avian (Southern Cross Junior), and a Lockheed Altair (Lady Southern Cross), each of which was used by Charles Kingsford Smith for record breaking flights.

The Southern Cross is quite an impressive exhibit and looks quite a large aircraft within its enclosure. In reality it has a span of 23 metres and carried a crew of four. It could carry twelve passengers for joy flights or eight passengers for Airline Operations. At the start of the long pacific flights it carried 8 tonnes of fuel. The fuselage is painted in Royal Blue and the wings in Silver Dope.

The three engines are Wright Whirlwind J5C, 9 cylinder radials of 220 Hp each. The same engine incidentally was used in the Ryan NYP monoplane of Charles Lindberg. The Wright Whirlwind was not especially powerful for its day. It was however a proven engine of exceptional reliability. In 1927 a Curtis Robin aircraft powered by a Whirlwind set an endurance record of 27 days, at Meridian Mississippi, a record which stands to this day!

I was at the time uncertain whether the Southern Cross in the exhibit is the original aircraft or a replica. My doubts were increased when I read an article in the Vintage Times (journal of the Australian Vintage Gliding Association) in which "Feathers" Crompton recounted that he was involved in the construction of a Southern Cross Replica. Further research on the World Wide Web (www) however confirms that it is the original machine. The replica may be still flying at the Parafield Airport, South Australia and has the original Southern Cross registration VH –USU.

In 1929 Kingsford Smith and the Southern Cross were missing on a flight to England. Running into a storm during the first leg to Wyndham, missed their destination and eventually ran out of fuel. They made an emergency landing on a tidal mud flat near Wyndham and were stranded.

The Southern Cross crew broadcast a short SOS before landing and an aerial search was organised, private aviators flying from the eastern states to join in the search. Two aviators in a Westland Widgeon (the Kookaburra), were lost during the search when their engine failed over the Tanami desert in the Kimberly District of Western Australia. The two airmen survived the forced landing in spinifex scrub but were unable to take off again. Their remains were found fourteen days later after they had died of thirst. The remains of the aircraft were recovered by Dick Smith in the 1978 and placed in a small museum in Alice Springs near to the Connelan Airways Hangar.

The episode became somewhat notorious because of the death of the two searchers and because of an ironic comment by Kingsford Smith in which he referred to the stranded crew drinking Coffee Royal whilst awaiting rescue. What he meant was that they had no supplies except some instant coffee and half a bottle of brandy!

The downed Southern Cross crew were found and rescued just before they starved and the Southern Cross was able to be flown out when the mud flats dried out during the neap tides.

Kingsford-Smith seems to have either abandoned or sold the Southern Cross because he was flying the Lockheed Altair when he was lost on an England –Australia flight in 1935.

The Southern Cross seems to have been acquired by the Department of Aviation possibly for the purposed of a Museum exhibition. It was seconded to No 3 Communications unit RAAF in 1945-46 and was used to make the Cine film "The life of the late Charles Kingsford Smith", then returned to the Dept of Aviation at Mascot.

The aircraft was restored and placed on display at the Eagle Farm Airport Brisbane in 1558. When the Brisbane Airport was moved to the current site the Southern Cross was also moved and placed in the new exhibition hangar.

The entrance sign to the park said it was also the site of the 460 Squadron Memorial. The memorial was such a modest affair that I was unable to find it for some time. Eventually I searched the garden under a nearby tree and found a plaque almost completely obscured by the foliage of overgrowing shrubs. Parting the fronds I was able to take the following photograph.

Could it be that one thousand airmen were lost from a single squadron in World War II? I don't think so. More likely they are referring to all the Australian airmen lost in Europe in World War II. Readers may have better information which they could convey to the next newsletter.

The Southern Cross Memorial is a very significant item in our Aviation Heritage. It was much more prominent in its old enclose near the passenger terminal at the Eagle Farm Airport and I have a vague memory of seeing it there. The new memorial is impressive but unfortunately it is located out of view from the main drive and remote from the terminals and therefore escapes the attention of the passengers rushing for their planes at Brisbane Airport. If you make a visit to Brisbane try to leave an extra 30 minutes on the way to your departure for a visit to the Kingsford Smith Memorial.

See all the photos at the end of the newsletter.

WHATS NEW

WOOD REPAIR COURSE At Bordertown Vintage Rally 7-15th January 2006

Keep those old gliders airworthy at home.You will need to construct a standard part before the Rally begins. Lectures and practical at the Rally will be held.

CONTACT. Keith Nolan, at (03) 5428-6163. or write to: 209 Sandy Creek Road. Riddell's Creek. Vic 3431.

A LITLE BIT OF GLIDING IN AUSTRALIA.

By Allan Ash,

The Murray Bridge Club.

A gliding Club was formed at Murray Bridge, South Australia, late in 1930, mainly through the efforts of a local electrician, Reg Harvey, who was appointed secretary.

Reg Harvey and Harry Jarvis spent about a year building a Zogling primary and test flights were made in March 1932 by Harold Bottril and Arthur Wilkins near Murray Bridge.

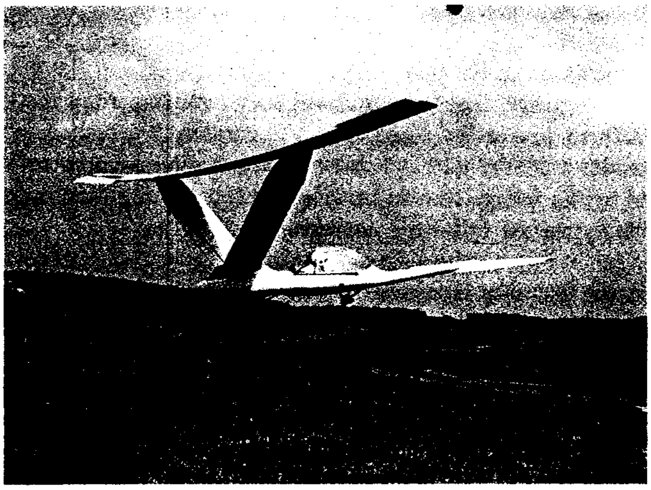
Reg Harvey was appointed as instructor of the gliding club and regular training began on the Zogling. They used a Model A Ford and three-quarter-inch manila rope for towing. On the nose of the glider was a hook which released the rope automatically when the forward pull stopped. A hangar was built on the aerodrome to house the glider and the club operated successfully for several years

THE AVIAFIBER CANARD 2FL

The first Foot Launched Composite Rigid Wing

By Brett Snellgrove

Eds Note. This is an excerpt from SKYSAILOR. October 2004.



The Canard 2FL is a canard rigid wing model developed in the late 1970's and early 1980's in Europe by Aviafiber (Dipl. Ing. Hans U. Farner) and was probably the first rigid wing foot launched hang glider ever developed. (A canard is a small wing-like projection near the nose of an aircraft, attached in order to create extra horizontal stability.) Mr. Farner was a university professor who became interested in applying the unique advantages of canard aircraft to a foot launched vehicle, just as the Wright brothers had done decades earlier.

The advantages of a canard are numerous. Firstly, having the stabilizing surface ahead rather than behind the main wing dictates the canard surface flies at a positive (rather than negative) angle of attack, and contributes to (rather than detracts from) the total lift of the vehicle. Secondly, since the canard is ahead of the main wing, it is typical to design the canard to stall first, dropping before onset of main wing stall. As such, even with full canard deflection, the wing tends to oscillate in pitch rather than stall. Although accelerated stall can be achieved, it was this important safety feature that kept the Wrights alive when many earlier aviation pioneers, such as Otto Lilenthal, had stalled and died in resulting crashes.

Unfortunately, every aviation paradigm has its disadvantages, and the canard has several. Since the canard must stall first, the coefficient of lift of the main wing is restricted to a number lower than the canard. (If the canard was to continue flying after the main wing had stalled the angle of attack would continue to increase, carrying the nose even higher and further into the stall). As such the full lifting potential of the main wing is reduced, and landing speeds for canard aircraft are typically higher than traditional, tailed aircraft with similar wing areas. Furthermore, since the canard is forward of the main wing, the turbulence and tip wash generated by the canard can pass over the main wing at inopportune times.

Mr Farner attempted to resolve these issues with several innovations. Firstly, he placed the main wing considerably higher than the canard by mounting it on V-wing pylons, keeping it out of the canard wash. This had numerous advantages in creating a very strong structure; the pylons provided additional wing area and by joining to the main wing reduced tip vortex. They also provided an ideal place to place airbrake spoilers allowing glide path control with sink rates of 0.6 m/s (120 fpm) and positioned the centre of gravity well below the main wing for additional stability.

This low centre of gravity also allowed the use of weight shift for pitch control. At launch the pilot stood with the legs protruding through bomb bay type doors, which closed after launch to reduce drag; pilot weight was supported on shoulder straps. (Though reclined positions as shown in the diagrams were experimented with, the prone position was adopted for the few versions sold). After launch the pilot rotated prone on a stomach board that slid fore and aft 80cm (32 inches).

The concept was, that in using weight shift and a low centre of gravity, the positive angle of attack of the canard relative to the main wing (needed to prevent main wing stall) could be reduced to an absolute minimum, increasing efficiency and allowing for lower landing speeds. In flight the pilot could shift forward, lowering the angle of attack of the wing and the canard. Unlike traditional canard control, the canard on the 2FL was fixed in pitch but free to tilt (or roll) plus or minus 5 degrees on the glider's longitudinal axis. This allowed the canard to act like a rudder in the same manner as a bird's tail and control any adverse yaw generated by aileron action, eliminating the need for additional devices such as tip rudders.

Unfortunately it was this feature that eventually killed Mr Farner on a tragic test flight. On one occasion he slid forward and apparently with the resulting nose down position and effect of gravity, lacked the arm strength to push back, or over-controlled the vehicle, (accounts vary) diving into the ground. This occurred after only a small number of 2FLs were sold. The business promoter (H. Bucher) decided to buy back all the gliders after the accident and then redesign and re-release the Canard as a motorized sailplane with traditional canard 3-axis type control. Given the exceptional performance of the 2FL it is difficult to understand why the wing could not have simply been modified to eliminate the weight shift component, substituting traditional stick, 3-axis type control and any slight theoretical performance deficit easily tolerated, retaining the foot launched capability. I imagine having a canard that both rolled to act as a rudder, and pitch the wing would be difficult to achieve, necessitating the need for additional devices to control adverse yaw as seen in tip rudders on the sailplane version in the photo.

In the 2FL, roll control was achieved by semi detached ailerons, which, when rigged for differential throw (travel up further than down), suffer less from adverse yaw and failure to provide effective control at angles approaching stall. It should not have been too difficult to incorporate spads as used in the Stalker to control adverse yaw without adding the weight and complexity of tip rudders used in the sailplane version. This would allow for a foot launched, stall proof glider with an LD in the vicinity of 30:1. Something that has yet to be achieved to this day.

At first glance the claim of 35:1 LD for the 2FL may seem excessive, but consider this, Farner had Lockhead as his client. The joined wing concept allowed an effective span of the main wing plus the pylons of around 65ft, without the tip drag induced by the vortices of bi-wings. The pilot was fully prone in flight and completely enclosed in a streamlined canopy and fuselage. Perhaps 35:1 was a stretch, but 30:1 sounds reasonable given the performance of the faired Swift.

The specifications were as follows:

Span: 13.5 m (44.4 ft)
Wing area: 13 m sq (140ft sq)
Length: 4.8m (15.8ft)
Weight: 110lbs
Best LD: 35:1
Packed size: 4.8m (15.8 ft)

The wing's construction was shell and spar with glass fibre resin laminations formed in female moulds; the core sections were Styrofoam. Future models were planned to have Du Pont Kevlar construction, saving two-thirds of the listed 110lb weight stated for the prototypes. Transportation was in two separate 4.8 m (15.8 ft) sections for car top box or trailer.

Given the performance of the 2FL, modern rigid wings look a little less technically sophisticated, especially considering the concept is over twenty years old! With modern materials and construction techniques, if ever there was a time to reintroduce this design it's now. I'm convinced with modern folding rib designs and composite materials the 2FL could be made significantly lighter and more easily transportable. I only wish I'd bought one when I had the chance...

Geoff Richardson

DESIGNER OF THE AUSTRALIA,S OLDEST AIRWORTHY GLIDER. Home Built.

"THE GOLDEN EAGLE" First flew on 26th September,1937

See photo by Peter Brookman at the end of the newsletter.

Flying had been a long-standing interest of Geoff Richardson by the time he left school, and his home in suburban Melbourne had seen this interest expressed in a series of well-made model aircraft which had performed well. Geoff was still a young teenager in 1929 when *Popular Hobbies* featured constructional drawings of the Zogling glider. Within a couple of months he had begun building but progress was rather slow and the work did not finish until October 1932. By this time Geoff had joined the Melbourne Gliding Club and begun training at the Coode Island aerodrome.

His Zogling attracted a lot of attention when it was taken to Coode Island to be test-flown. Made throughout of silver spruce, the workmanship was excellent and the glider was brightly painted with a red and white fuselage and gold wings and tail. Test flights were carried out by Ray Garrett and the machine was found to fly well. Thereafter, the Zogling be came a regular participant in the club's flying activity and, after several years, was bought by the club.

By 1934, Geoff Richardson had realised the need for a more advanced machine and began the design of a sailplane of 44 feet wing span. The design was influenced by the latest trends in Germany but was not simply a copy of any particular machine. Construction of the sailplane, which was named *Golden Eagle*, took three years, during which time the young pilot had advanced in experience to being one of the club's instructors as well as its president.

MALCOLM BENNETT'S "SUPER WOODY"

Weight and Balance

By Peter Raphael. (The Erudite)

Those of you who have been following the progress of Mal Bennetts "Super Woody" will no doubt realise that it is nearing completion. One of the final, and most important steps before it takes to the air is the completion of a Weight and Balance exercise. Our experience over a number of completed projects has taught us that it is prudent to conduct a preliminary weighing in order to ascertain the approximate status of the aircraft before committing it to a pre-evaluation flight inspection. This provides the opportunity to avoid any surprises and make any adjustments necessary within the services of the home workshop.

With this in mind, Mal with a little difficulty, obtained the use of the GFA scales. Seems you have to have formal qualification to use the scales these days! Then a time was arranged for James, Mal and myself to gather in Mals workshop and conduct the weighing. The primary concerns when doing a weight and balance are those of C of G and of G loading. At minimum pilot weights the aircraft will be flying at the aft limit of its C of G and this can introduce adverse pitch sensitivity and unpredictable spinning characteristics. At maximum pilot weight the aircraft will be at its forward C of G limit. Beyond this, elevator authority may be compromised, leaving insufficient travel to effect a round out at low speeds. More significantly, excessive fuselage payload increases the wing loading and the potential for maximum design loads to be exceeded in thermal gusts or at maximum maneuvering speed.

Obviously the all up weight is not only single factor influencing payload. As the fuselage also has to be carried by the wings, the weight of this becomes significant in calculating maximum pilot weight, and this is why the wings are weighed separately.

On the day the process we undertook was to first weigh the wings and fuselage separately. It is an important part of the calculation to know the weight of non lifting parts. After this the aircraft was assembled and placed on the scales. The designer will usually specify a leveling datum and in the case of the Woodstock this is the rear fuselage longeron.. Once this was done the C.G. datum, which happens to be the leading edge of the wing, is plumbed to the floor and measurements taken from here to the centre of the main wheel and tail wheel are recorded. The actual C.G. range is specified by the designer of the Woodstock as between 273 (forward) and 357 (aft) back from the datum. The measurements, in conjunction with the weights are used to calculate the moments of the empty aircraft. Once this has been done, pilots of different weights are loaded in the cockpit and additional tail weights are recorded.

By knowing the additional weight placed in the cockpit and the variation in the weight at the tail wheel it is possible to calculate the resultant C.G. location. The GFA MOSP covers the weighing of gliders of various configurations and should always be consulted in applying this process. It is quite easy to misinterpret a mathematical sign and move the C.G. in the wrong direction!

I have deliberately omitted any reference to actual values here as they are subject to adjustment but suffice to say that indications were that some ballasting of the nose will be necessary in order to provide a useable pilot weight range.
Stay tuned for the final chapters in this latest project

HINTS & TIPS

Tracking the CG in Design, and Afterwards

By Stan Hall

Science and flying experience over the long term show that having the sailplane balance at the right place on the wing's mean aerodynamic chord (mac) is critical to stability and control. They also show that these two elements conflict, that what you gain from one you lose from the other. Keeping these elements in harmony nominally spots the " right place" for the center of gravity (CG) at between 20% and 30% of the (mac) aft of that chord's leading edge.

In sailplanes the problem is their wings; their high aspect ratios yield very narrow wing chords. That 10% range, translated into inches, can in performance machine amount to scarcely more than two inches.

Trying to hit a target that small can be a real chore for the sailplane designer. Working with much bigger targets, major airplane manufacturers consider the job suffiently important to require assigning whole engineering groups to the sole job of keeping a running account of the weight of each of the hundreds, sometimes even thousands, of pieces in the airplane and where they locate in the aircraft so as to determine where the final CG is likely to land. And this effort starts from the 3 view drawing of the machine and continues right into flight test. Even with the use of computers, mistakes are far from uncommon. Serious errors get engineers fired, less serious ones find the culprit pilloried on the horns of gross humiliation. Because somebody blew it the airplane has to be ballasted and must now and forevermore fly, carrying weight that just lays there enjoying the ride and not paying a cent for the privilege, while costing expensive OPEC fuel better used to make the airplane go.

Weight control involves extensive book keeping. The tedium involved makes it among the most boring activities in the engineering world. It is hard to stay alert, and one is giving the wonder why we don't see more weight engineers, in response, running, screaming off into the sunset.

I doubt many sailplane designers ever had to earn their keep in the Weight Group of a major airplane manufacturer. It is thus understandable they might not appreciate the importance of keeping books, weight wise and so, simple ignore it. As a consequence they can find themselves coming head with a very ugly word: BALLAST. Unfortunately, ballast plays a big part in the design of such machines and you'll rarely find a sailplane without it. The performance penalties of carrying useless weight are obvious.

But all is not lost. Tracking the CG need not to be boring. In fact, it can actually be FUN. Put your computer to work, press a few buttons and then sit back and watch those CG locations spill out. Computers simple love book keeping.

I have developed a computer program that will help you to do this. It doesn't involve hundreds or thousands of pieces, only 10 of the most important ones.

There are 6 more vacant slots for weight items of your own choice. You determine the weight of your items via pencil and paper or for preliminary estimates, the Stender, computerized program offered before. Then you tell the computer what they weight and where they are in the aircraft relative to a datum, which in this program is the main landing wheel. You do no math at all once you punch in. The computer does it all quickly, accurately and , without ambiguity, tells you where you stand CG-wise any time you ask for it. The beauty of this is, it does the job while you can still do something about it on your drawing board (where you keep your erasers). If your CG isn't where you want it, move something in your design, poke another computer key and watch its effect on the CG- and keep doing this until it lands right where you want it. Easy as pie-and twice as tasty.

The program. Once you type in 3 critical dimensions right at the start. Cover three cases:
Case 1 is for aircraft still on the drawing board.
Case 2 covers the situation where the aircraft is already built and weighed empty and you want to know where the CG will land when the disposable weight (the crew, etc) is figured in.
Case 3 represents the case where the aircraft is weighed at its all-up (gross) weight/ Pick your case and go to work

As a scarred realist I recognize the world is far from perfect. As anti-ballast as I am I know from experience that sometimes a designer designs himself into a corner he can't design his way out of, one where his options are ballast, start over or stay on the ground. To cover these unwelcome eventualities I have included Case 1, which tells you if you simply have to have ballast and have a good, strong place to install it, how much you will need. But if you tell anyone you heard it from me I will deny it.

I will E-Mail the program to you. Just ask. It is available at zero, nada, zip cost through the Internet. Contact me at my E-Mail address, shall2@silcon.com (don't forget the numeral 2 and note that "silcon" has only one "I" as in "eye". The program will work with any computer equipped with the Excel spreadsheet program (vital). It comprises around 130 lines of code essentially all of which tell the computer what to do. It looks complicated. It isn't.

A closing note to the designers of Ultralight sailplanes: You and I both know how hard it is to design a safe and practical flying machine for only 154 pounds, this to avoid arousing the intense interest of the FAA. Since the pilot's weight is such a large portion of the gross weight of an Ultralight, even a slight change in his location in the aircraft will have a big effect on the CG. This makes keeping a running account of it in design a must. The computer will make it easy. Ballast? The word can't even be in your vocabulary!

SMILE ☺

By members demand. If you do not like it, please skip it!

Dad comes home from work and ask's Mum where his son is.
"In the garage playing with his new chemistry set" says Mum.

As Dad walk's towards the garage, he hears a banging noise and, upon opening the door, sees his son pounding a nail into the wall.

'Hang on son, Mum told me you were playing with your new chemistry set. Why are you banging that nail into the wall?'

His son replies, 'Dad, it is not a nail, it is a worm. I just put these chemicals on it and it became hard.'

His Dad gets very excited and says,' Tell you what son, give me those chemicals and I'll give you a brand new Volkswagen.'
Quite naturally, the son agrees.
The very next day, the son goes into the garage and sees parked in the garage a brand new Mercedes.
Just then, his Dad walks in.
'Where's the Volkswagen?' asks the son.
'Right there behind your Merc.'

'Where did the Merc come from?' ask the son.
'It's a gift from your mother!' replies Dad.

Eds Note: I bought a chemical set but something went wrong!. Now I have to be faithful to my old "VOLVO" 240 GL.

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Same old guy, driving home from his bowls club's annual Christmas lunch, answers the car phone. He hears his wife's voice sounding very distressed and urgently warning him, 'Claude, I've just heard on the radio there's a car going the wrong way on the South Eastern Freeway. Please be careful'

'Hey', says Claude,' not just one car Beryl
There's hundreds of the buggers!.

TECHNICALITIES

THAT MAGICAL TURN OF THE CENTURY

The story of lift generation following the ideas of Lanchester and Prandtl
Part 1.
By Sergio Montes,

The correct explanation of the generation of lift by a wing due to Frederick Lanchester in England and Ludwig Prandtl in Germany must surely count as one of the great achievements of human intellect, not only of aerodynamics. The story is not well known, except in specialized courses and books and it is worth retelling for its intrinsic interest and applications in aircraft design. This is the first part of the story, and it will be followed in the next issue by a presentation of the next epic achievement of Ludwig Prandtl, the "Lifting Line Theory', which is the true basis for understanding that important source of low-speed drag: the "induced drag". The name of this article simply reflects the fact that so many great discoveries in Science as well as Art masterworks came about that time, just before WW1, and not only in the centers of development of Western Europe and USA, but also in Russia, Latin America and Australia. It was an astonishingly productive era.

Lift and drag

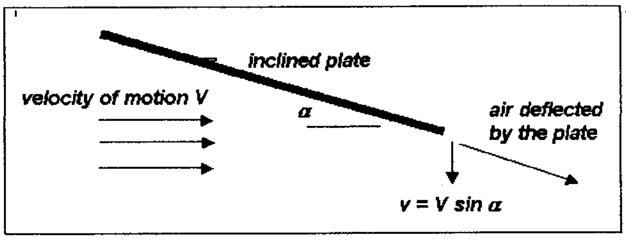
Sir George Cayley, that great precursor of the science of flight, was the first to analyze (in 1809) the force of air onto a plane inclined with respect to the motion. The component of the force generated by the plane perpendicular to the motion constituted the Lift, that parallel to the motion being the Drag. Cayley found that time was not yet ripe for the airplane and left this line of research to concentrate in lighter than air vehicles.

The accepted theory at the end of the 19th century was simple and it consisted of equating the Lift of the wing with the downward momentum of the air deflected by an inclined plane of area A moving forward with velocity V, and inclined at an angle α, which represented the wing (Fig. 1).

If v is the vertical velocity of the air behind a wing, then the vertical momentum is $W = mv$, where m is the mass of the air being deflected. Newton had assumed two centuries before that this mass was equal to $m = \rho A V \sin\alpha$ and as the vertical velocity v equals $v = V \sin\alpha$, then the vertical momentum W is

$$W = \rho A V^2 \sin^2\alpha .$$

The problem of course is that this hypothesis on the mass of air



deflected down by the airfoil was in great contrast with the results of the experiments on lift already being performed at the end of the 19th century. On the strength of Newton's model of airfoil lift, it seemed impossible to contemplate the idea of flight, and many scientists said so, unequivocally. The eminent Lord Kelvin stated in 1895:
"Heavier-than-air flying machines are impossible".

Durand (ref.1) says: ..."at this point (1897) Lanchester came forward with his remarkable physical insight". And it is this remarkable insight that is the topic of this presentation on the solution of the lift problem, and which enabled such dazzling progress in aviation during the first decades of the 20th Century. It is well, however, to remember that new ideas do not burst fully matured or fully recognized, or even in one place, and this is particularly the case on this situation.

Who was Lanchester?

Frederick Lanchester was born in London in 1868 and trained as a Mechanical Engineer in London and Southampton. He was a truly outstanding inventive genius, covering fields as wide as aerodynamics, mechanical engineering design, motor-car manufacturing techniques and the science of warfare. Here is a list of just his important automotive inventions:

1890 Gas engine starter
1895 First all British four wheel gasoline car
1896 Magneto ignition
1897 Automatic lubrication of engine,
1897 First go & no-go gauges.
1898 Rack and pinion steering
1901 Pre-selector gear change
1902 Turbo charging, disc brakes
1904 Four wheel drive
1905 Dynamic balance of engine
1923 Fuel injection
1927 Purpose-built armoured cars.

His main ideas on lift had been worked out by 1897, but were not published until some time later. As the list of his inventions above indicates, he was by this time fully occupied in setting up a car manufacturing business, and designing and perfecting such cars. In 1907 he published his book " Aerodynamics" where he dealt in detail with his ideas on lift generation. It must be said that his writings are not easy to follow, as he insisted in using, as he put it "plain English divested of all mathematical ornament". It was this difficulty that precluded many people from giving his ideas serious consideration and allowed the independent derivation of this lift theory by scientists in Germany and in Russia to become better known.

Circulation

The main feature of the explanation of Lanchester was the existence of a state of motion about a wing generating lift that we call "circulation". Lanchester called it something else (peripteral motion). Essentially it means that around the wing, one can recognize two types of motion, the ordinary motion along streamlines slightly deflected by the airfoil, plus a rotating motion of air encircling the wing, as shown in Fig. 2, and **without which no lift is possible.**

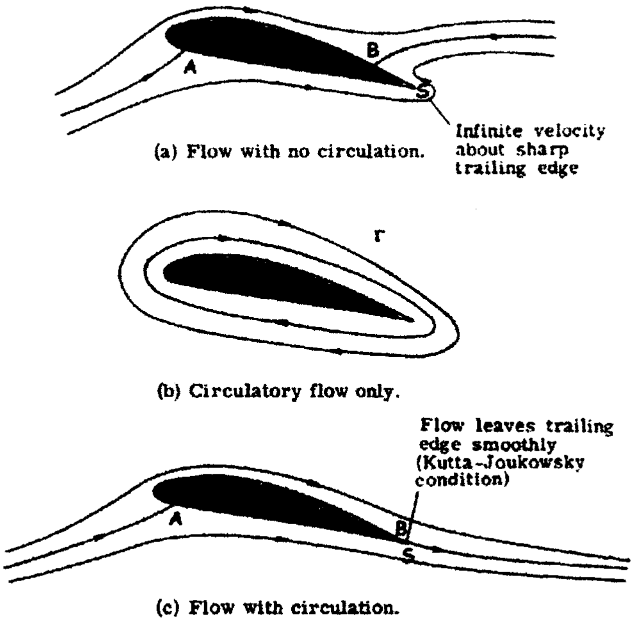


Fig. 2

A simple explanation of why the combined flow due to the airfoil translation and circulating motion produces lift can be understood by noting that given the type of circulation shown on Fig. 2, the circulatory motion will increase the speed of the air over the top of the wing, and decrease the speed along the bottom of the wing. This means that for a fluid with a very small viscosity (as air), where the energy of the flow is sensibly the same over and under the wing, it follows from Bernoulli's equation that the pressures on top of the wing p_u must be smaller than those at the bottom, p_l.

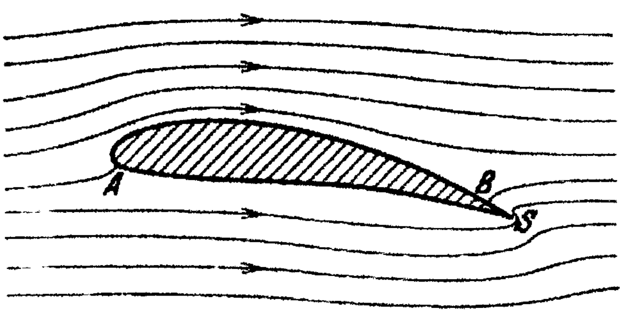
$$E = p_u + \rho\frac{V_u^2}{2} = p_l + \rho\frac{V_l^2}{2}$$

$$p_u = p_l - \frac{\rho}{2}(V_u^2 - V_l^2)$$

$$or\ p_u < p_l$$

This difference in pressure will result in a vertical force directed upwards, the Lift of the wing.

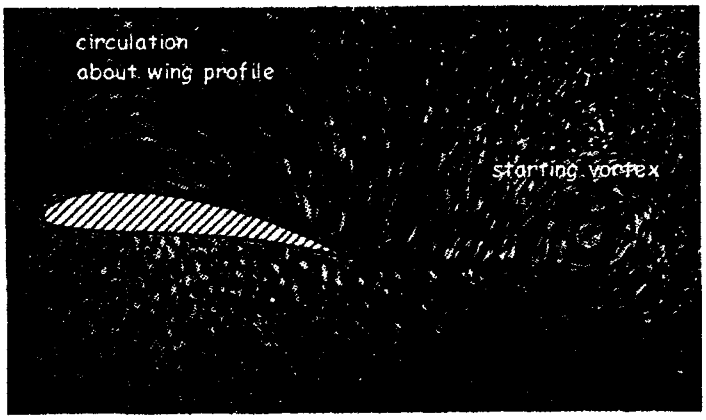
Of course we have no idea yet of the magnitude of the circulation that is generated over the wing, nor yet of how this circulatory motions is established. In a fluid with zero viscosity, the free streamlines of the flow do not look identical to the streamlines of Fig. 2, but look similar to those in Fig. 3.



This artifice of zero viscosity allows the mathematical calculation of the streamline plot of Fig. 3.

The main difference from our point of view is the fact that there are two points of zero velocity, points A and B , where the streamline contact the surface of the airfoil, and on which the velocity is zero. It is noteworthy to see that at the rear of the airfoil, the flow near point B goes around the sharp trailing edge. In contradistinction the flow in the real case does not show at all this tendency, and the streamlines near the trailing edge of the airfoil follow the airfoil profile as in Fig. 2.

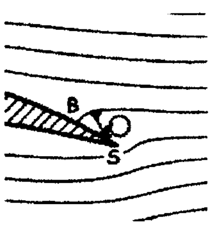
However, there is a brief instant of time during which the fluid around an airfoil behaves as it had nearly zero viscosity.



The starting vortex

Assume for example that the wing profile in Fig. 3 is not moving with respect to the air, and that it is suddenly accelerated to the left. During this brief, initial, moment, the viscous effects will be negligible and the flow pattern will be as in Fig. 3. As the flow tries to turn around the sharp trailing edge S, a very high (theoretically an infinitely high) velocity is required at the edge. This high velocity would imply a very low pressure at the trailing edge S, but there is enough kinetic energy in the flow at S to allow the flow to reach B over the airfoil boundary..

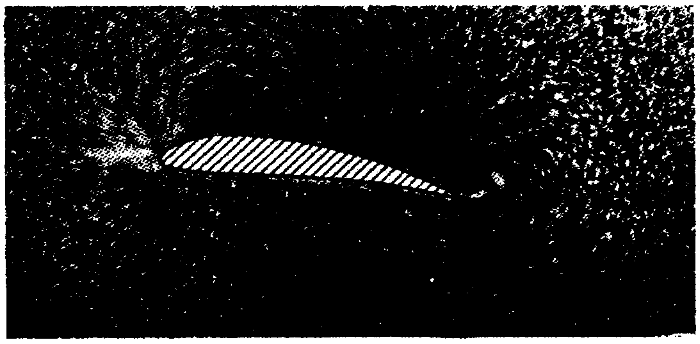
Viscous effects in the fluid will reassert themselves as the motion of the airfoil to the left progresses, with the consequent retardation of velocities near the boundary. Now the kinetic energy of the flow at S is not sufficient to drive the flow from S to B, and the rear point of zero motion B will have to move closer to the rear edge S. At the same time, a backflow appears, due to the fact that pressure to the left of B is higher than that at the trailing edge S. As a consequence the flow separates from the airfoil, and produces a vortex at the trailing edge as shown in Fig. 4



This vortex, which is formed along the whole trailing edge of the airfoil is the "starting vortex", and is not stable, being washed away to the right by the motion of the airfoil.

Some of the best experimental pictures of this complex flow affair were taken by Ludwig Prandtl and his team of researchers at Goettingen, Germany, and are shown in the following figures. Prandtl devised about 1910 a way to capture this motion. His airfoil was mounted on a carriage that transported the airfoil along a rectangular open channel filled with water. Very fine aluminium dust was sprinkled on the surface of the water and these particles could follow the instantaneous motion of water and could be photographed to show their position, being highly reflective. The camera travels with the airfoil, so that the pictures describe the fluid motion with respect to the airfoil.

Fig 5 described the motion as the stating vortex is just leaving the trailing edge of the airfoil. The vortex motion can be clearly seen at the rear of the airfoil as shown by the streaks due to the motion of the aluminium dust particles, curling about the trailing edge. The starting vortex is situated there just over the trailing edge, as in Fig. 4.



The next figure shows the starting vortex displaced some distance to the rear, being left behind due to the motion of the airfoil to the left.

One can also see in these two last pictures another vortex forming near the leading edge of the wing, the streaks showing the motion of the fluid trace a circulatory pattern that nearly embraces the whole width of the sing on the last photo. This vortex is produced as a reaction to the starting vortex, because in a fluid with zero or very low viscosity (the initial moments of the motion allow this analogy) if there was no vorticity at the beginning of the motion (static fluid), no net vorticity is allowed afterwards. The starting vortex, that is shown gyrating counter-clockwise in the last figure must have a "partner", a vortex of equal intensity , but rotating in

the opposite direction, so that the net vorticity of the fluid is unmodified. This vortex over the wing is the "circulation " motion that we mentioned was indispensable for the production of lift.

Summarizing the steps of this picture: the airfoil which was initially I repose is given an accelerated motion in a static fluid. The conditions at the trailing edge are such that a vortex forms there and is detached from the profile by the motion of the airfoil. As soon a the starting vortex forms, a vortex of similar intensity but opposite rotation is created over the airfoil and the intensity of this circulatory motion increases gradually from zero to some

final, and yet undetermined value when the starting vortex is a long distance away from the profile.

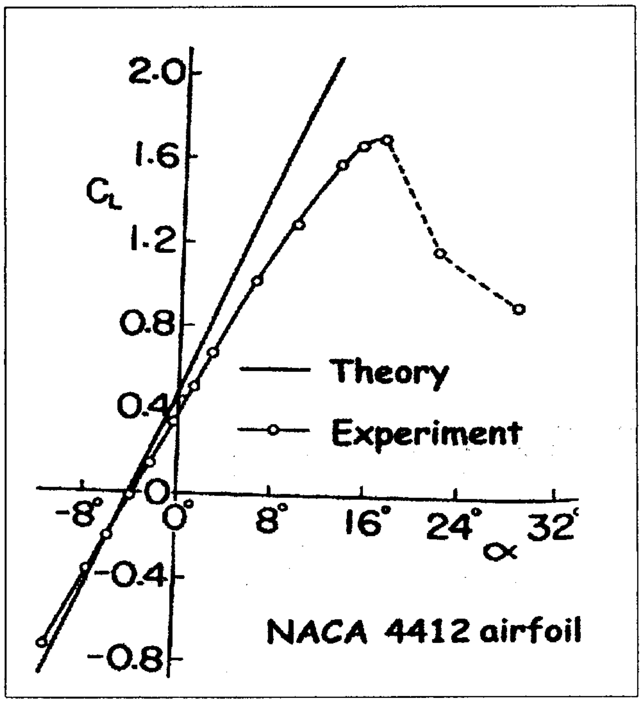
Kutta and Joukowski

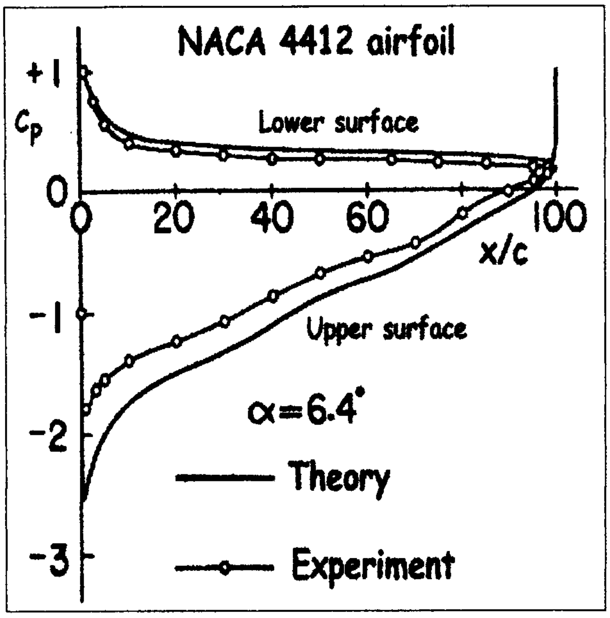
It may be recalled that at the beginning of the motion of the airfoil, the point B of zero velocity at the rear of the airfoil moved toward the trailing edge S in Fig. 3. This displacement has the effect of creating a smooth flow around the trailing edge of the airfoil, with the same velocity at either side of point S. This is what can be observed in the following figure, also obtained by means of Prandtl's experimental device. Note that in this photo the camera and airfoil are still, the fluid moving with respect to them.

A few years after Lanchester introduced the concept of circulation, two European scientists, Wilhelm Kutta, a German mathematician and Nikolai Joukowski, a Russian engineer, determined independently the amount of circulation, by proposing that this value should be sufficient so that the flow over the trailing edge is smooth. It is not difficult to realize that the amount of circulation necessary to smooth the flow at the trailing edge has a unique value, lesser values would place the point of zero velocity B on the upper side of the airfoil, excessive circulation would displace it to the lower contour. The Kutta-Joukowski condition, as it has come to be known, provides the circulation theory with a realistic condition which allows the calculation of the lift when the airfoil has reached stable conditions of motion. The real test of this theory is of course how well the values of lift and pressure distribution derived from it agree with careful experiments.

One set of experiments used the well-known NACA 4412 airfoil at various angles of attack, for which the two following figures are illustrative. The variation of coefficient of lift with angle of attack shows a fair agreement with experiment provided that the angle of attack is below say 10 degrees, the quality of the predicted CL being quite good at the small angles, including a very accurate prediction of the angle of zero-lift.

The distribution of pressure on the top and lower surfaces of the airfoil was also tested on the NACA 4412 airfoil and the results, for the angle of α equal to 6.4° is





shown in the two previous figures

It can be said that the theory provides a good agreement, both in shape and magnitude the theoretical pressures conform well with the measurement.

Let us go back to the statement at the beginning on the great difference between the predictions of the Newton theory and the Circulation (Lanchester) theory. The coefficient of lift calculated with Newton's theory is:

$$CL = 2\sin^2\alpha$$

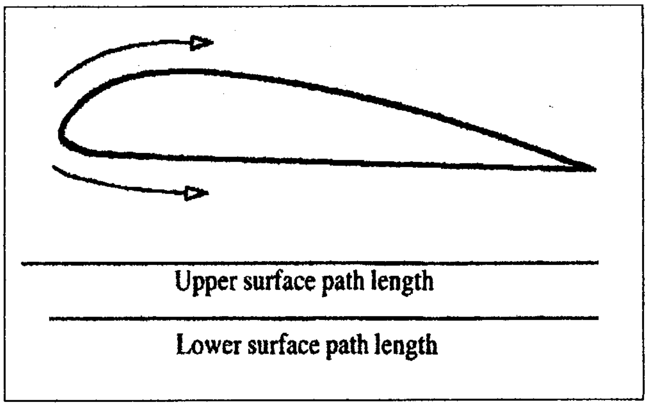
So for α equal 4 degrees, the CL (Newton) is close to 0.01. In contrast the CL computed from circulation theory is about 0.95 from the Fig. Xx, the difference is about two orders of magnitude! Part of the explanation resides on the fact that Newton's lift model assumed that only the lower surface of the flow is active on producing lift, in practice, that is the smallest contribution, as the part played by the suction (negative pressure) on the top part of the airfoil is considerably more important, as can be inferred by a comparison of the areas under the pressure curves in the last figure. To finish this first part of the article, a short and lighthearted look at a most common (and thoroughly false) explanation for lift from an airfoil, from ref 3.

Plausible falsehoods

During most of the 20th century, much of the popular teaching of how wings work has been false. In part this has been deliberate. Dr. Theodore Von Karman, a most prominent aerodynamicist in mid-20th century, once told his assistant, later the famous Professor Bill Sears at Stanford: "When you are speaking to technically illiterate people you must resort to the plausible falsehood instead of the difficult truth." This attitude, of course, would require the speaker to judge the listener's technical literacy or lack thereof. In any case, a lie is not a good substitute for true teaching.

Plausible falsehood is still being taught. The most popular theory of wing operation, which we may call Hump Theory, because it requires a wing to have a more convex upper surface as compared to the lower, is easily shown to be false. Hump theory is based on Bernoulli's law, according to which pressure and velocity are inversely related, and on a principle of equal transit times, according to which air passage over an upper wing surface must occur in the same time as air passage below. In order to have the same transit time, flow at a more curved upper wing surface, having a longer path, is said to be of greater velocity than that at a less curved lower surface, making upper surface pressure less than that at the lower, in accordance with Bernoulli's law.

Upper surface flow is indeed faster than the lower, so much so that transit time at the upper surface in typical normal flight is always LESS than at the lower. Although Bernoulli's law is sound and well proven, the premise of equal transit time is invalid and without foundation in known physics. Thus the most popular explanation, world-wide, of wing operation is false, and easily shown to be so. The falsehood is not due to Bernoulli's law, which is well proven, but rather due to falseness of the principle of equal transit times.



References:
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A LITLE BIT OF GLIDING IN AUSTRALIA

By Allan Ash

Fremantle Gliding Club. Western Australia.

A meeting was held in Fremantle Town Hall in 1930 to form the Fremantle Gliding Club, The meeting was called by a man named Marsh who claimed to have flown gliders in England and suggested that the club should build a glider that he had designed. In addition, he offered to provide flying training for the club members.

This" training" turned out to be a crude set of control set on the floor of a room in his house.

Twice a week for months, while they were building the glider, the club members paid a shilling a lesson for instruction on this device.

When the glider was completed, the members took it to Welby's paddock at Bibra Lake for testing. After several flights to about ten feets, the club captain landed on a fig tree. It was repaired and flown again . Arthur Farmer, later to be a driving force of the Western Australian Gliding Club, was one of those who learned to fly on it.

Merry Christmas and a Happy New Year.

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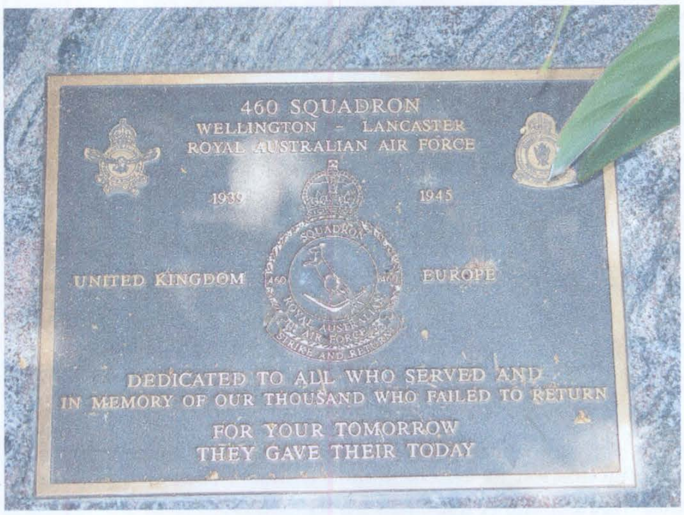
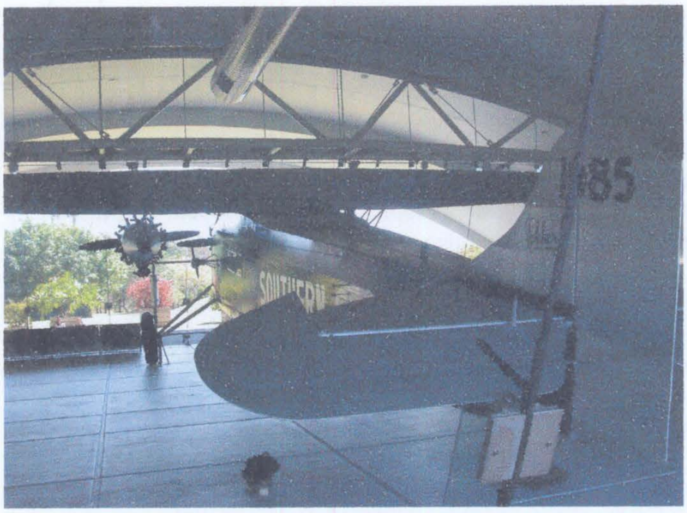
Southern Cross hangar



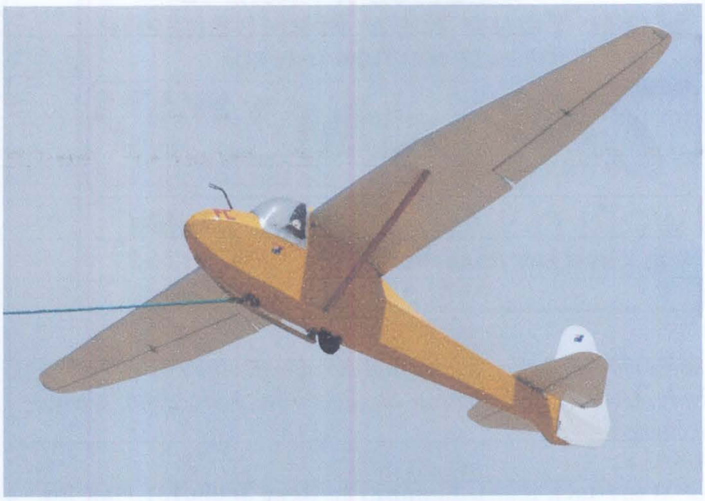
460 Squadron memorial.

The Southern Cross.

The Corby Starlet built by Norm Edmunds.



The Southern Cross



The "Golden Eagle" .designed by G.Richardson.Owned by Claude A Patching.