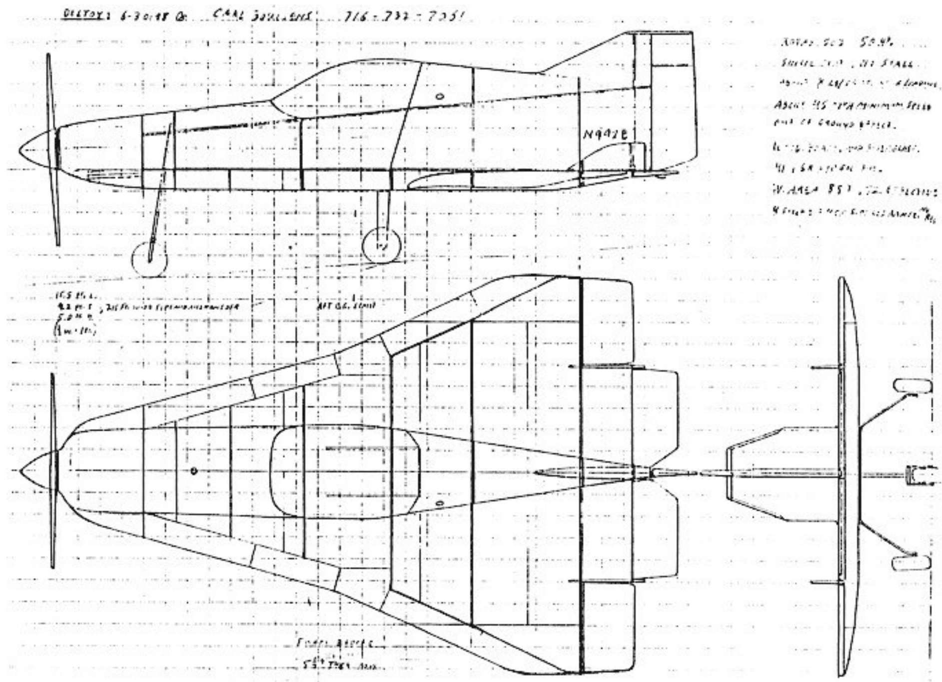
No. 153 **MARCH 1999**

T.W.I.T.T. NEWSLETTER

Carl Bouwens' DELTOY 1



See page 2 on the inside for more on this design and what plans he has for its future development

T.W.I.T.T.
The Wing Is The Thing
P.O. Box 20430
El Cajon, CA 92021

The number after your name indicates the ending year and month of your current subscription, i.e., **9903** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, March20, 1999, beginning at 1:30 pm at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - Southeast side of Gillespie).

THE WING IS THE THING
(T.W.I.T.T.)

T.W.I.T.T. is a non-profit organization whose membership seeks to promote the research and development of flying wings and other tailless aircraft by providing a forum for the exchange of ideas and experiences on an international basis. T.W.I.T.T. is affiliated with The Hunsaker Foundation which is dedicated to furthering education and research in a variety of disciplines.

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Meetings are held on the third Saturday of every other month (beginning with January), at 1:30 PM, at Hanger A-4, Gillespie Field, El Cajon, California (first row of hangers on the south end of Joe Crosson Drive, east side of Gillespie).

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PRESIDENT'S CORNER

First of all I would like to thank Peter Selinger and Bob Recks for their contributions to the newsletter this month. There must be some ESP going around since the both sent in material about inflatable aircraft. Peter's covered the most recent experiments in this field, while Bob's had a more historic aspect to it with a wing from the 50's. Unfortunately, I had to cut out one of the articles sent in earlier by Eric du Trieu de Terdonck in order to have enough room for the complete article written by one of the aircraft designers.

For those of you who haven't looked at the web site recently, I have made some major changes to the lead page to make it easier to use and appear less cluttered. Hopefully, shortly after you get this newsletter, I should have the links page updated with some new items that I am sure many of you will enjoy. They include both R/C model and hangglider links, so there is something there for everyone.

I hate to keep getting up on my soap box, but we really could use some help on putting together new programs. With the booming economy, it has been a little harder to find people who have the free time necessary to prepare and deliver a 45 minute presentation, especially on a Saturday. We have a line of some potential programs for the coming months, but there is no guarantee the speakers will be available when we need them. SO, if you know of anyone who can provide a flying wing relevant subject, or you have a topic you would like to share with the group, please give us a call or drop us an e-mail. Presentations don't have to be fancy, just informative on a subject of interest to the entire group.

I hope you enjoy this and future newsletters as I try to include more pictorial material, especially of the meetings.

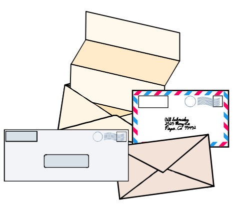
Andy

MARCH 20, 1999 PROGRAM

We are pleased to announce that our program for this month will feature **Dr. Philip Burgers** (TWITT Secretary). Dr. Burgers' subject will be "Flowfields Around Man-Made and Natural Wings." This will cover the flowfield around flying wings, single birds, bird formations, and in ground effect. He will present some previously unpublished results from his vortex lattice computer program which is designed to evaluate and solve the flowfield around two birds flying in formation and ground effect, simultaneously.

Dr. Burgers is interested in the aerodynamics of birds and their origins. He has recently submitted an article on a new theory of the origin of bird flight to Nature magazine. A few weeks ago he was invited to present another paper on the same subject at a Yale University symposium on "New Perspectives on the Origins and Early Evolution of Birds."

This should be a very enjoyable program, partly because of Phil's presentation techniques that will inform and amuse you, and partly since it will touch on some of this new theory on bird flight. The more we understand about this phenomenom, the better we seem to understand how to improve the preformance of flying wings.



LETTERS TO THE EDITOR

1/19/99

TWITT:

I have enclosed my renewal, as well as, a picture and paper.

The aircraft is called Deltoy 1, and can be seen in the December issue of Kit Planes, page 43. Carl Bouwens has almost finished it. For a fifty horsepower engine it looks fast. A good project after I finish my U-2 wing.

Scott Bridges
Scappoose, OR

(ed. - Thanks for the renewal and material. As you can see I was able to get the 3-view to come out good enough to put it on the cover and add the text of the letter below. This freed up some space inside for the other letters that follow.

It's nice to know there are people out there building things since so much of what I see on the Nurflugel chat board is simply theory and lots of questioning of what is good or bad.)

DELTOY 1

December 22, 1998

Late July '98, things were going great so I prepared some info for the KitPlanes directory, for the "Under Development" section. In August some personal misfortune occurred; I called KitPlanes in September and asked that the info be pulled out and was told I had called just in time - that in a day or two it would have been too late to change. This was a relief to me because I was estimating a 4 to 6 month delay in getting Deltoy 1 airborne. (The KitPlanes directory contains many errors - for example there is a photo of the exact same plane being sold by two completely different companies and, another company's two seater is listed as 20 mph faster than their single seat version with the same engine and wing, etc.)

I'm sorry to inform you I still don't have a firm idea of first flight date but should have by late March '99, when I will mail you again. I am returning the $6 you sent; you early birds will get a free info pack when I have close to 40 hours on the plane.

From the calls and letters I have received to date, while you like the idea of a small delta-wing plane, most of you would prefer a two seater and a four stroke engine. There is a possibility that spring of '99 will find me deciding to not market the Deltoy 1, but instead go full bore on getting the Deltoy 2 flying. Initially I had intended it to be a thick wing tandem for more commonality with Deltoy 1, but it will be a thicker wing and side-by-side. Thirty gallons of fuel max, Cont. O-200 (110 hp if 60" prop) max size and weight engine (Subaru typical), more plywood/fiberglass and less foam, same 7' center width but a few feet more total span, same length. Scale model flies great. Should only take 10% to 20% more time to build, kit about 30% more expensive, plus probably a few thousand for an engine - 100 hp = 200 mph cruise.

Sincerely,

Carl Bouwens

P.S. - Center body width chosen to allow rolling flat into a U-Haul truck, like if you're far from home when your engine quits. Most Ryder trucks are slight wider.

P.P.S. - I have made over 100 flying scale models of delta wings. Next kit after the two seater will also be a delta.

(ed. - Peter Selinger sent us a lot of material on flexible structures, including many pictures of one such aircraft that is a unique flying wing. This came at a time when we also acquired some material on another inflatable from Marc de Piolenc via Bob Recks, so it seemed appropriate to show you two different sides of this concept. First from Peter a composite of two e-mails sent to a person named Yasuhiro in Japan. I have also included pictures of each of these aircraft so you can get an idea of what Peter is talking about. I will also post these and some of the specifications on a new page on the web site in the next week or so.)

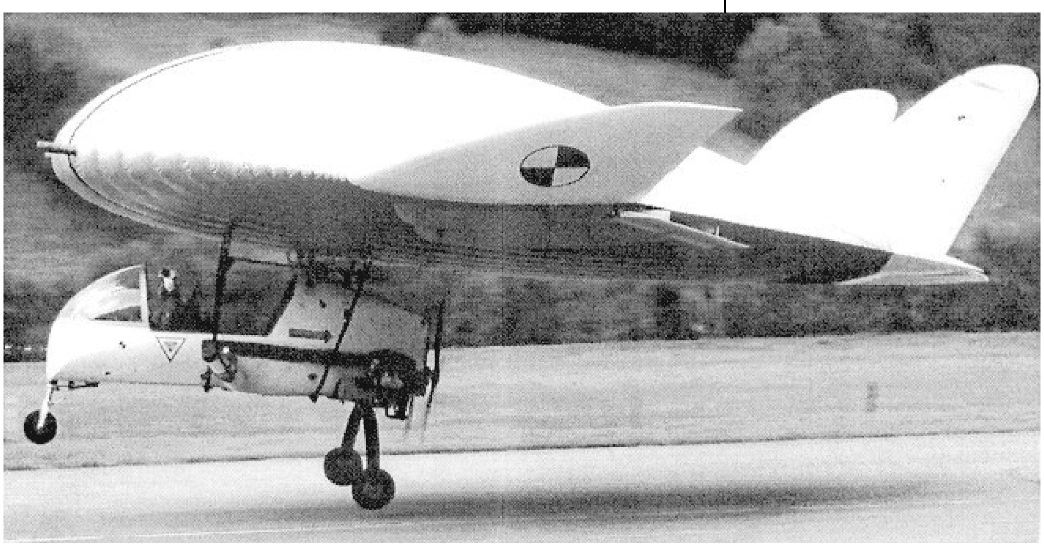
Flexible Soft Structures For Solid Flying Wing

Prospective Concepts of Switzerland present pneumatic developments for general aviation.

May 27th, the higher Simmental in the south of Switzerland offered a great environment scope for very new aviation developments, set into reality in the past years by Prospective Concepts, based near Zürich. The main idea is to give aircraft bodies the required stiffness and strength by air pressurized plastic film structures. To meet this for ultralight planes with a wing of higher aspect ratio they need less than 1 bar, which is also enough for a very uncommon design, the Stingray.

In the past years of hard and creative work for their German client and customer FESTO (a world leader in pneumatic tools and machine devices, for robot also) they got a lot of experience with such soft elements as plastic films, for FESTO's original production program a fluidic (pneumatic) muscle that is now in series production, replacing a pneumatic cylinder and its punch, and avoiding any moveable parts, therefore, affording nearly all maintenance efforts for its lifetime.

To prove all these techniques in aviation they built a lot of test-beds, all for that goal "Stingray", a V/STOL flying wing fun aircraft for 12 people, sitting within the wing and with built-in catapult, giving the capability of starts on a soccer or baseball field. Its slow landing speed, comparable to those of the ultralights, would allow it to land in the same area. As a proof of concept (POC) the baby Stingray (see above) succeeded with more that 180 test flights since the first flight in 1995 at a former sowjet base in Czechia, to keep it secret. But now they fly in Switzerland with a special permission for development purposes at St. Stephan, a Swiss Air Force Field, which should be opened for commercial use in 2000 - an ideal base for prospective concepts to improve their designs with a good aviation infrastructure in back. This POC baby Stingray has 2 seats, only for tests of all the aerodynamic characteristics, before they build the big one. Very well experienced and famous Swiss test pilot and home-builder Gion Bezzola showed the baby Stingray during the presentations, and also in flight during a heavy rainstorm in this mountainous area.



To test the catapult system they used a special ultralight, the Känguruh (Kangaroo) high wing, high lift plane with a minimum speed of 43 km/h. The pneumatic cylinder-system accelerated the Känguruh from zero-speed to flight without turning the wheels on the ground.

The other ultralights, as Pumpolino II and Pneuwing prove the construction methods for higher aspect ratio structures as the wings of an aircraft. Please remember the design philosophy of avoiding solid bars and struts. The airfoil shape is ensured by the internal vertical films between upper and lower side, the stiffness and strength of the wing becoming from air pressure of 700 mbar only, enough for 6g load! You can see from the picture of the interior of the Pneuwing's structure that the airfoil contour is kept by plastic-film-webs in a spanwise direction. The advantage is also, that leaving out this small air-volume, you may pack the aircraft wing very small by rolling the wing-film and laying it over the other one. For the same purpose the Pneumagic rigid-wing hangglider (pilot seated in the middle behind the wing and controls the aileron and flaps by electrical remote control) was to show the chances and future possibilities these construction methods offer.

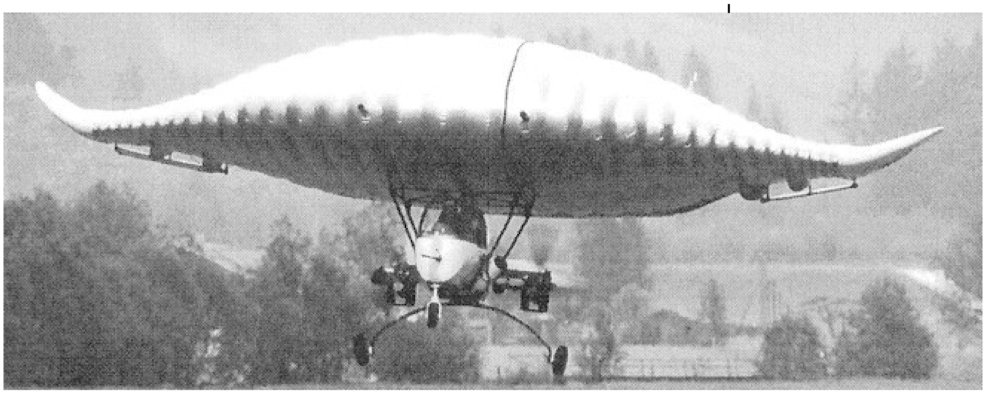
Safety will also be an important point on the test list. A motorized plane will easily be kept full and hard by a little air-pump coupled with the engine, even if there would be a small hole within the surface. For a motorless glider, as the hangglider, they expect 20 minutes of time to land between the opening of the hole in the surface and the point of reduced strength and stiffness of the wing. But these things have to be tested very carefully in the future, they promised.

In hopes it will help you,

Best regards,

Peter

(ed. - I would like to thank Peter for this excellent contribution. If many of you recall, Alain Mirouze has presented several inflatable all-wing ultralight hangglider designs over the years, so it will be interesting to see how far these newer concepts go in revolutionizing this aspect of the sport.)



ABOVE: Front view of the POC Stingray. You can see the twin engines on either side of the fuselage and the aileron type devices just inboard of the upswept tips.

(ed. - The material below was provided by Bob Recks after he obtained it from Marc de Piolenc via e-mail. The source is unknown, but appears to have been published February 2, 1973. The picture will probably not reproduce very well, but is the best that can be done with the file available. You can see from the two articles this concept obviously hasn't died since the 1950's, it was just in hibernation.)

Just wait a sec' while I pump up my airplane

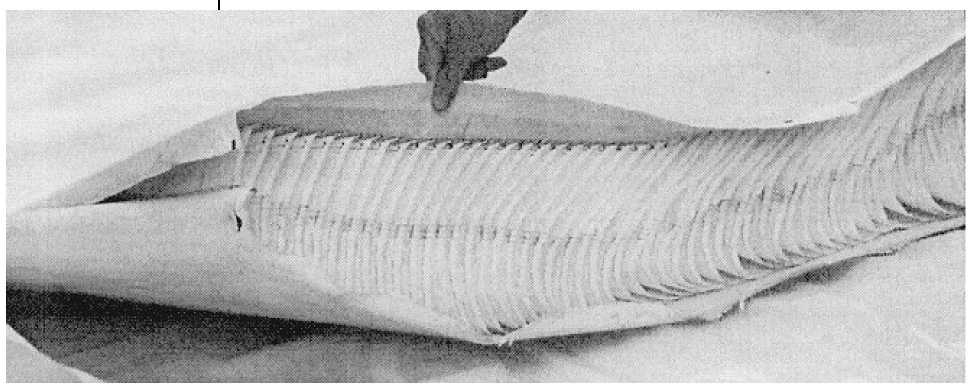
At a time when the thoughts of many people in aviation were turning seriously to the possibility of a resurgence of the airship, Britain is in the forefront of world experience in aircraft that can be inflated and flown.

Experiments in this field, both inside and outside government establishments, have reached an advanced stage, and although they have never been taken through to full-scale production, the country now has a considerable fund of esoteric knowledge that could be produced should lighter-than-air machines ever make a serious comeback.

Inflatable aircraft have many uses, the major one being as sporting or number of military applications may also be imagined. People in most of the developed countries have money and leisure to spare, so this type of machine could find a major new market. Experiments in Britain have proved that they are simple to fly and, because of their inherent elasticity, are far safer than aircraft constructed of the traditional materials. They are cheap to manufacture, and even cheaper to operate; one had no engine at all, relying on the pedaling power of the pilot!

The experiments proved that it is perfectly feasible to build a machine of a suitably tough material, power it with a small engine and propeller, give it the most ample flying controls, and it would be capable of a series of rudimentary hedge hopping maneuvers. On the completion of its outward flight, it could be immediately deflated and stored —with its small power plant in a space about the size of the trunk of the average car.

For the return journey the skin of this remarkable



ABOVE: A view of the internal plastic web structure of the POC Stingray as described in the article.

vehicle could be inflated from bleed air from its own engine. Once blown up to size, it could take off from the smallest patch of level ground. Back at its home base it could quickly be let down and packed away once again....

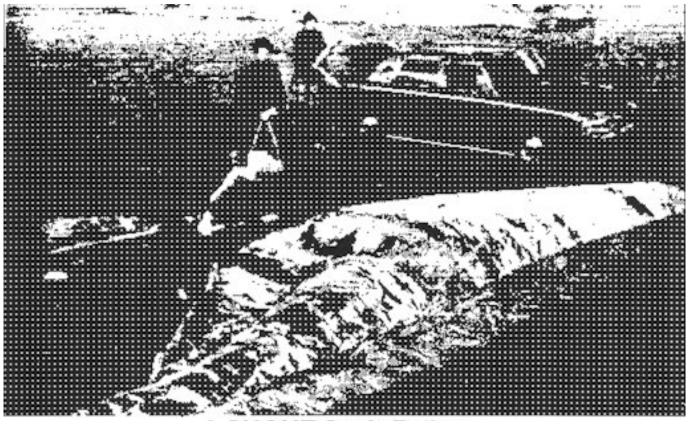
Experiments on the inflatable aircraft were carried out at the Government's inflatable center at Cardington, Bedford, where the enormous hangers in which airships were housed before World War II still remain.

A man who knows a deal about inflatable aircraft is Dan Perkins, a senior experimental officer at Cardington, who built and flew one as a private venture and at his own expense.

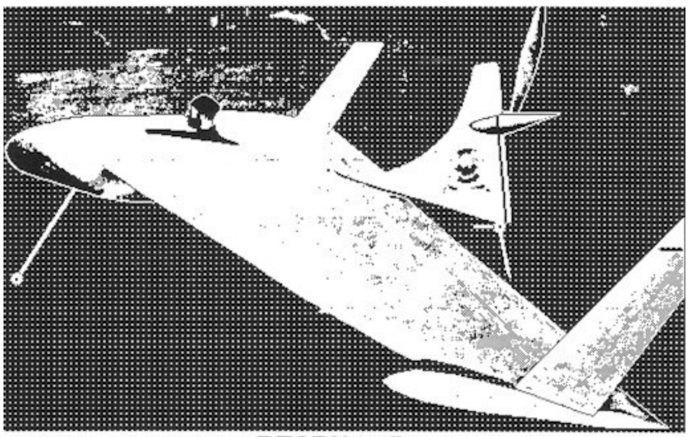
He experimented first of all with a machine with long narrow wings ---- something approaching the shape of the modern high performance glider ---- then changed his plans until what emerged was a far more squat vehicle with a wing-span of 27 feet and a total area of 250 square feet ---- about the same as a World War II Spitfire.

At about the time of his experiments the Kremer prize for man powered flight was in the news, and be Mr. Perkins hoped to compete. He did not carry off the $37,500 prize for flying round two pylons a half a mile apart in a figure of eight (nobody else has, so far) but the basic soundness of his idea was proved in no fewer than 96 flights.

The aircraft which he produced was made of polyurethane-proofed nylon with a backbone of duralumin tube. It was tail-less and the pilot sat in the wing. To



LAYOUT for inflation



READY to fly

ABOVE: This is the best picture available of the inflatable, pedal powered flying wing. The pilot's head can be seen just forward of the wing's mid-point, and a thin nose-gear strut and small whell protrude from below the nose area. There appear to be tip rudders, and a vertical fin aft of the pilot to carry the propeller.

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inflate, the skin was filled with air driven by a centrifugal fan, power for which came from a car battery. Topping up was done with a foot pump.

It took 45 minutes to get ready (and an hour to pack it away again) and the pilot powered it by pedaling a 9-foot, 6 inch propeller connected through a belt drive.

Although the concept was unusual, the inflatable aircraft was successful ---- far more so than many of the more conventional machines which were competing for the Kremer prize at that time, only two of which actually flew.

It was certainly a lot lighter, at 39 pounds (less than the weight of an ordinary bicycle) than its competitors, which weighed anything from 130 to 280 pounds. Its pilot, Mike Street, an amateur cyclist had never flown an aircraft before, but found it so simple that he mastered the inflatable after only three-attempts. The control column was based on a cycle handlebar with a twist grip to make the make the machine move up and down. All that was needed to make it bank to port or starboard was rocking motion to either left or right.

(ed. - Bob also provided us with the additional article by Dan Perkins, referred to above. Perkins apparently was the Deputy Head of the Research and Development Establishment, Cardington, which was part of the Mechanical Engineering Department of the RAF. It appears to have been published on April 8, 1960, but the source is, again, unknown.)

Inflated Fabric Aircraft

by D. Perkins

When I was asked to write an article on air-inflated aircraft, which particular reference to a small 6 hp delta wing, I was somewhat dismayed at the task of recalling details of an aircraft designed and made in 1955. Being a poor recordkeeper and an inveterate "off the cuff" designer, it has involved me in the study of lots of small grubby pieces of paper, some incomplete and often inaccurate drawings, and a great deal of memory searching.

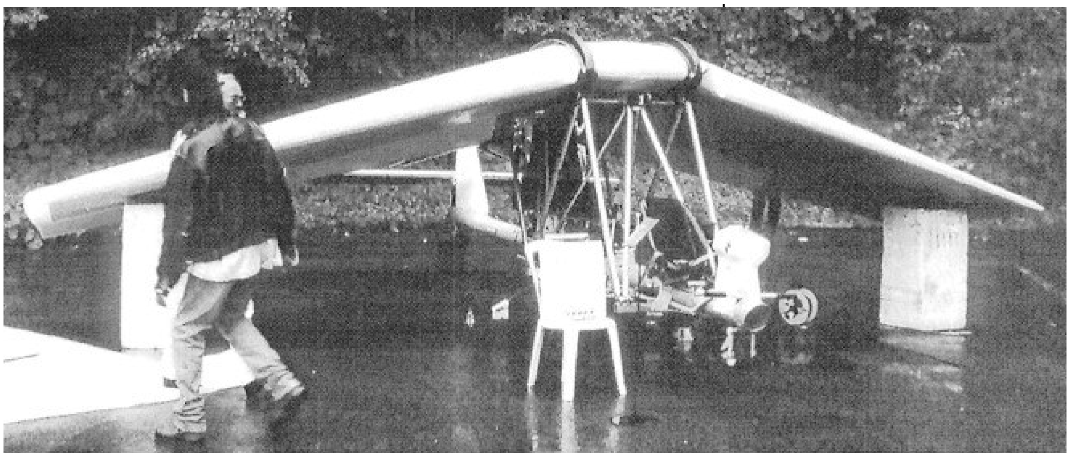
Photographs of a developed two-seat air-inflated aircraft appeared in the Press some time ago. (See THE AEROPLANE, May 31, 1957.) The prototype, designed, made and flown at Cardington, had a delta wing of 500 sq. ft. area, mounted on a tricycle frame. A two-seat in-line cockpit was built within six vertical members supporting the wing, and attached to the two rear members was a 70 hp target-aircraft engine, driving a pusher propeller. Controls consisted of half-span elevons, with a single rudder mounted on the upper surface of the wing. They were operated by a normal stick and rudder bar through flexible steel wire. The gross weight was about 900 lb. As with almost every aircraft ever built, it was felt that a much more efficient machine could be designed, once the prototype had flown.

Cardington had, as most people know, always devoted its efforts primarily to the problems of making inflatable equipment and by this time I had become an even more ardent believer in the future of air-inflated aircraft and was given permission to continue development on a small scale.

It had been my belief, from the early stages, that the ultimate aim should be an aircraft that was completely inflatable, except for the engine and wheel struts. With this object in mind, and assisted mainly by Mr. Alan Lock, work was started in 1955.

The first obstacle to be overcome was the lack of a suitable power unit, but since the only engine available below 70 hp was a 6 hp twin-cylinder two-stroke, it was "Hobson's Choice."

We had, some time previously, built an inflated full-size orthodox model of an Auster, using the 6 hp engine with a direct drive to a 3' propeller. Since the engine ran at 4,000 rpm, the propeller was very inefficient, we only managed to extract 1 hp from it and the machine prove capable of only short hops. Also, the cockpit and tail unit were still of rigid construction, although the fuselage was all inflated. The machine was not capable of being deflated and rolled up, and the engine, designed to run flat-out only, had given some trouble.



ABOVE: (I know, this doesn't have anything to do with this article, but it is the only place I could put it.) This is the Pneuwing from Peter's article during the deflation cycle. It is obviously a more conventional design, but shows how the pilot cage can be attached to the wing.

However, by gearing down the engine, through two Vee-belt pulleys and a lot of jiggerty-pokery to the carburetor, including the incorporation of one large drawing-pin for a float needle, we managed to get 1½ hp from the propeller! The unit, when complete, resembled an outboard motor, incorporating petrol tanks, dry batteries for ignition and hooks on the end of the two control wires, and weighed 40 lbs complete.

It was designed to clip on to the rear end of the fuselage and was supported by the two spark-plug bodies and one peg. The control wires from the pilot could then be hooked on, and the longest job was doing up the six propeller bolts. The propeller was of laminated spruce and weighed 4 lbs. For those interested in the facts of life, one 4' propeller equals a lot of bad language, two sacks of shavings and considerable loss of blood!

While these engine troubles were being sorted out, construction of the wing was going ahead.

We had returned to the delta plan form, for it strength and simplicity of manufacture, but changed almost every detail of its construction.

The first major change was to reduce the wing area to 160 sq. ft., since we did not, at the time, believe we could carry two men on 14 hp. Some of our well meaning but rather depressing visitors often expressed the view that we could be lucky to lift one!

The make sure that the original prototype machine was stable and easy to fly, the wing had been swept back 90º and washed out 10º at the tips. Combined with a low C.G. this had reduce the efficiency of the wing at top speed, since it required large elevon angles to make small changes in pitch.

Its efficiency was further reduced by it thickness/chord ratio of 25%. This deep section was chosen, to give maximum rigidity, but when built it was found to require down bracing to the fuselage.

It was clear that, if we were going to improve the aerodynamic characteristics of the machine, some means of stiffening the wing must be found.

A study of a pneumatic beam in bending, through a series of tests, showed that its resistance to deflection was a measure of the load extension curve of the textiles used to make it.

We were then able to build a beam in which we had incorporated special materials in the surfaces and succeeded in reducing the deflection to 10% of the original. Using this new information, we reduced the sweepback to 64º with a thickness/chord ratio of 20% and aspect ratio increased from 3 to 3.5. The wing section was R.A.F. 69. To make the machine more maneuverable, the washout was reduced to 8º at the tips.

Built as a pure cantilever, we estimated that the wing would sustain 4g up and down loads at 1 lb./sq.in. pressure; test on the completed wing confirmed this.

To further reduce the drag, we made the wing in a lighter material by dispensing with the aluminum protecting surface and "skinned" the whole thing with a very light silvered textile, thus covering the corrugations in the surfaces, necessarily there by the method of construction.

The elevons on the early prototype had been operated by orthodox wire pulleys and levers. These had imposed local loads in the surfaces and required further local load applied by rubber cords, to achieve static balance.

To be rid of these difficulties we developed pneumatically operated full-span elevons which worked by means of inflatable tubes inserted near the root of the elevon hinges. When an elevon had to be moved, air was allowed to escape from one tube to atmosphere , while air from the wing was fed into the other. To make only one pair of wires necessary, the operating valve was situated at the inboard end of the elevon trailing edge and was spring-loaded to return the elevon to the full "up" position. This gave "feel" to the pilot, since he had to overcome the load in the spring before the elevon would move. To ensure that the elevons returned to the neutral position, a suitable spring was applied to the control wire at the pilot's end of the system. Incidentally, the whole aircraft, with the exception of the engine unit and wheel bearings, was of non-metallic construction.

It will be appreciated that when a pneumatic aircraft climbs there is an increase in the pressure difference and it is necessary to fit a safety valve. Conversely, when the aircraft descends, it is necessary to replace the air valved on the way up. This was done by means of a windmill-operated plastic blower, and, of course, in level flight made good the amount of air used by the control system, slight leaks, and so on.

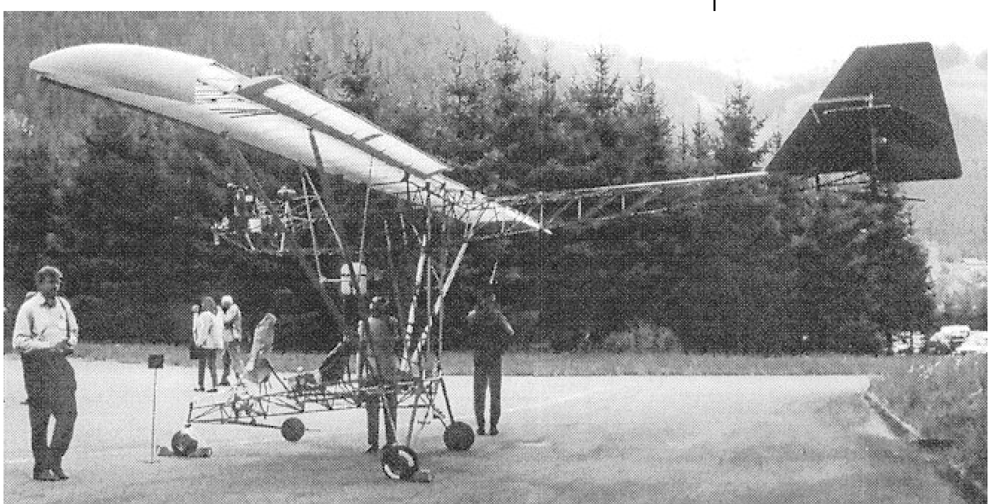
As the aircraft had no tail unit, fixed fins were clipped on to the outboard ends of the elevons, to give maximum moment.

Before proceeding further, we decided to take the completed wing onto an airfield for towing trials, to determine among other things, the accuracy of our estimates of the mean center of pressure and the lift/drag ratio of the wing alone. We were grateful to find that the tow-load, i.e., the drag, of the wing in level flight was somewhat lower than we had hoped.

Much encouraged, we then proceeded to build, what may best be described as the pilot's cabin and the wheel units.

The cabin was basically an air-inflated slab about 12" thick descending from the underside of the wing, with a forward projecting cylinder slightly longer than a man's leg. The whole slab was then faired in by an outer skin, complete with curtained doorway, and front and side windows of transparent flexible plastic sheet.

The pilot sat on the projecting cylinder of air with his back against the leading edge of the slab, to which a seat-belt was attached.



ABOVE: This is the Kanguruh (Kangaroo) high wing test bed for proving the zero speed launch system would work correctly. It also illustrates how to take the simplisitic approach to doing a POC to get it done in the shortest time and the lowest cost. It almost looks like it could be turned into a good ultralight of its own.

The outer skin was attached to the underside of the wing on an airfoil profile and was tight enough to put the slab into compression, so that the local load imposed by the pilot's weight was distributed evenly along the attachment line. The pilot was virtually suspended in the outer skin.

Controls were all hand operated. A square sectioned column of the forked front wheel (plywood, and tired with a deck quoit) projected upwards between the pilot's legs. On this was fitted a vertically sliding pair of handlebars, to the outboard of which, descending from the roof, were attached the elevon cords. From the lower part of the column ran the cords operating the rudder, mounted behind the propeller.

To turn the aircraft left or right, one turned the handlebars as on a bicycle; to climb or descend one slid them up or down, and to bank, tilted them port or starboard. Not having flown an aircraft I wanted something fairly simple!

The throttle control was a friction-held sliding knob on the left-hand wall of the skin, whilst the ignition switch took a similar form on the right, with the additional feature that it could be pulled down like a communication cord, to hold the choke closed for starting.

The safety valve, which also served the purpose of inflation and deflation, was situated above in the front of the pilot's head, and could be manually operated if necessary.

To complete the cabin, two instruments were fitted. One was a pressure gauge reading to 2 lb./sp.in., and an airspeed indicator which read to a maximum of 35 mph.

The undercarriage consisted of two streamlined spruce struts and a half-axle on either side of the cabin, the top end of the struts and the inboard end of the axle terminated on a plywood disc attached to the pressure surfaces, which supplied both springing and damping. All joints were quickly detachable single rope hinges.

The 6" by 20" wheels were made of 3-ply dinghy fabric and two plywood discs. The tread was applied in the form of about 100 coats of rubber solution, each wheel weighing 2 lbs. and operating at 6 lb./sq.in. When deflated the tires could be folded into the size of the discs.

The aircraft was now complete, and with ¾ gallon of petrol in the tank, weighed 167 lbs.

For transportation by road, the aircraft was deflated and rolled up around the propeller and wheel struts, making a bundle 14" in diameter and 4'3" long, whilst the engine unit was packed complete into a 16 sq.in box.

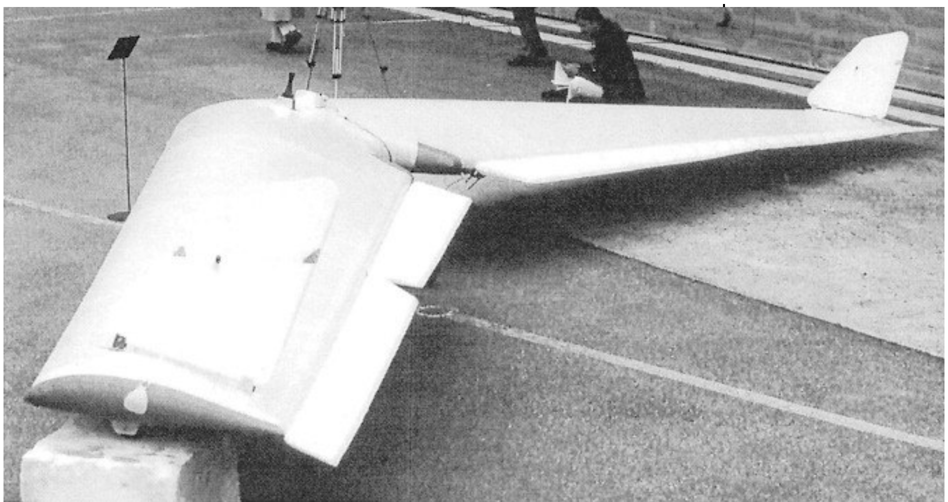
Using a large domestic vacuum cleaner, it was possible to inflate the aircraft and be ready to fly in 25 minutes.

On January 25, 1956, we took the aircraft to a disused airfield and began towing trials with a dummy engine, to collect data and generally test the structure.

On March 7, wearing a crash helmet, and, I am assured a look of great apprehension, I took my seat in the cabin and strapped myself in.

The engine was already warmed up, and since it was now too late to back out, I gave it three-quarter throttle and signaled the chocks away and immediately began to roll down the runway.

In about 150 yards the ASI was reading 23 mph and I very gently raised the front wheel, at least was what I intended to do! In fact, it came up smartly and I found myself at an altitude of 4' and rising fast. This was at



ABOVE: This is the Pneumagic rigid-wing hangglider noted in Peter Selinger's article. The short black object sticking up towards the leading edge is the electric joy stick for contoling the evelvons. Due to the contrast you can see the tip fins which appear to be in a fixed position.

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least twice as high as I considered safe, and promptly pushed down too hard! The ground began to rush up towards me, and that part of my anatomy nearest the concrete began to warm up in anticipation. However, when I did touch down, it was almost imperceptible. The struts, cushioned on the wing, did their job well.

In the days that followed, I made quite a number of short flights, some of which were in a side wind, but I did not attempt any turns.

On one occasion I found myself at about 20' up, with the control wires crossed. I spun down to the concrete at 45º. I drew my legs up in preparation and switched off the engine. As I hit the deck, everything folded up about my ears - and then, just as suddenly, straightened out again. I had felt nothing and the aircraft has sustained only slight abrasions on the front of the keel.

I mention this, as it is my firm belief that this type of construction could provide the safest type of light aircraft possible. Such aircraft are almost indestructible except by fire. The pilot is surrounded by compressed air bags and there need to be few solids to injure the body.

The wings need only about a 4g load factor, mainly to keep good shape, since up loads of more than this only progressively fold up the wing tips. This does absolutely no harm to the wing and since one must be rising in these conditions, one only need wait until they cease, for the wings to pop back straight again.

In conclusion may I attempt to dispel a popular misconception. Pneumatic aircraft are *not* susceptible to punctures in the air. The materials used are woven to make them almost untearable, and one hardly ever comes across nails and broken glass "up there."

prospective concepts : aircraft - data

	dim	Känguruh (Cangaroo) 1-seater catapult-test-plane	pumpolino II 1-seater	baby stingray 2-seater poc-test-plane	pneuwing 2-seater	pneumagic 1-seater, rigid-wing ultralight glider
span	m	13,0	9,0	13,0	8,2	12,0
wing area	m²		17,0	70,0	16,5	15,2
wing volume	m³			68,0		
differential pressure	mbar		700	20 - 50	700	
length	m	7,0	6,0	9,4	6,2	
height	m	3,3				
engine	Type	Rotax 582	Rotax 503	2 x Rotax 582	Rotary 814	
power	kW	47	35	2 x 47	59	
take-off weight	kg	400	335	840	320 (1-seat)	130
max. load	g			4,5	6,0	
speed min	km/h		62	47	50	40
speed take-off	km/h	43				
speed max	km/h		100	130	150	100
speed vert.	m/s			2,5		
best glide ratio						20
remarks, as number of test flights				> 180 test flights		1st flight estimated for June 1998

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