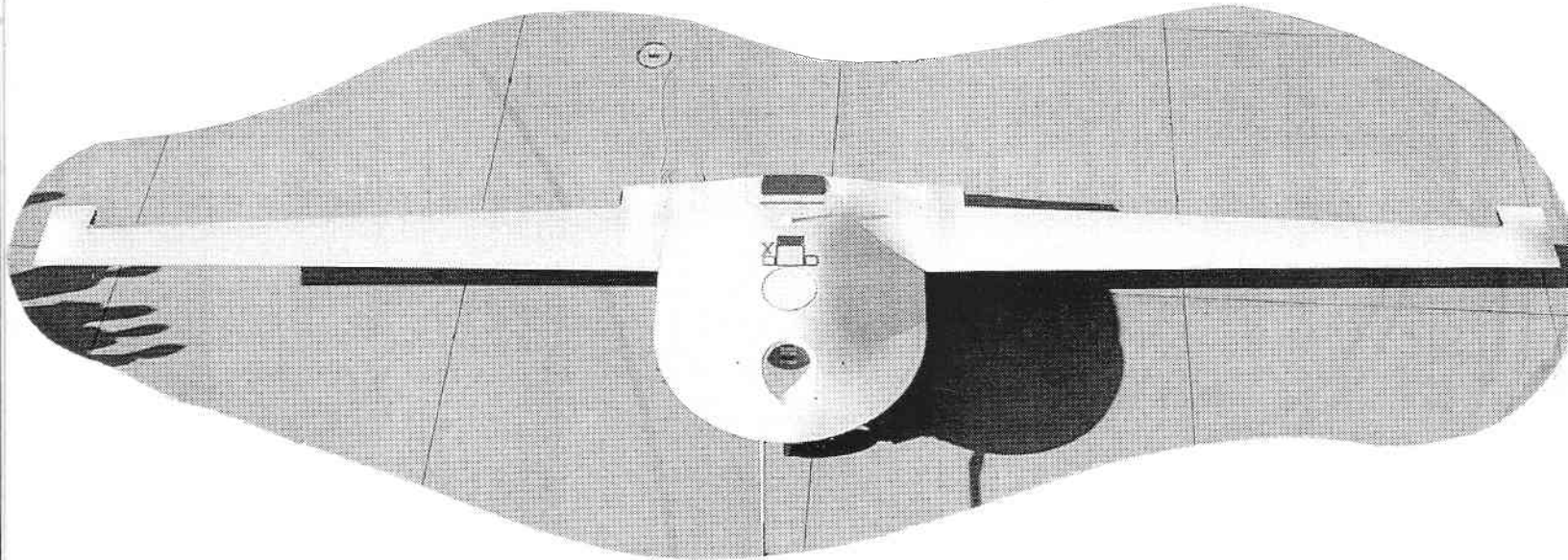


T.W.I.T.T. NEWSLETTER



One of the prototype Tier 3 DARKSTAR aircraft on the ramp at Edwards AFB in 1995.

Source: Dryden Flight Research Center EC95 43271-5.

T.W.I.T.T.

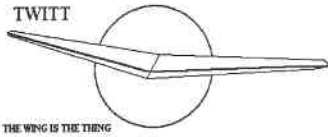
The Wing Is The Thing

P.O. Box 20430

El Cajon, CA 92021

The number to the right of your name indicates the last issue of your current subscription, e.g., **9805** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, May 16, 1998, beginning at 1330 hrs at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - East 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.

T.W.I.T.T. Officers:

President: Andy Kecskes (619) 589-1898
Vice Pres: Bob Chase (818) 336-5485
Secretary: Phillip Burgers (619) 563-5465
Treasurer: Bob Fronius (619) 224-1497
Editor: Andy Kecskes

The T.W.I.T.T. office is located at:
 Hanger A-4, Gillespie Field, El Cajon, California.
 Mailing address: P.O. Box 20430
 El Cajon, CA 92021

(619) 596-2518 (10am-5:30pm, PST)
 (619) 224-1497 (after 7pm, PST)
 E-Mail: NBKP63A@prodigy.com

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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

This was a good month to catch up on the letters we have received in the past few weeks. I would like to thank Alain Mirouze for his extensive contributions of prototype construction techniques which I have included as sort of a feature article this month. He made it exceptionally easy by sending everything along on a disk in formats I could use in Mircosoft Word so it was just a matter of reformatting the presentation and you can all enjoy the outcome.

A late arrival in the mail from Peter Siegfried asked if anyone knew what happened to the Aero-Dynamics, Inc. AQUILLA motor-glider project. It was advertised in the May '78 issue of SOARING and was being offered by Ultralite Sports in Seattle Washington. I seem to recall this came up a number of years ago and it was no longer a viable project or available in any form. If anyone out their knows the fate of this aircraft, please let me know and I will pass it along to Peter.

So as not to put pressure on anyone I won't name names, but one of our members has now done the test flying of his new Pioneer and is quite pleased with the performance and handling. He has agreed to send us an article on the project in the next few weeks. Once we receive this I will include it in the newsletter so everyone can understand the joy one feels upon the successful completion of such a project. Perhaps it will give some else the morale boost necessary to hit the workshop a little longer each night and get that one of a kind flying wing project into the air this summer.

I also found out we may have some hardware to show at the May meeting, so make sure to come and enjoy the program.



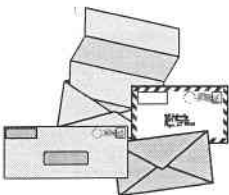
**MAY 16, 1998
PROGRAM**

The May meeting takes us on a participants look back at private, military and experimental flying wing aircraft as he has experienced them over the years. **Bob Fronius** is going to take us on a tour of his nearly seventy years of personal adventures and historical involvement with flying wings.

At times he was a spectator and others he was deep into with the white knuckles to prove it. An unverified ancestor by the name of Phineas Pinkham helped John Montgomery and later the Wright brothers by selling or trading them ideas. A short stop in Elmira NY helped start a glider movement in that area. This experience is verified by official Washington documentation, the San Diego newspapers, the U.S. Weather Bureau, San Diego Aerospace Museum and, the book Progress in Flying Machines.

He is putting together some video footage of the Horten machines, historic military aircraft and many of the flying wings from the San Diego area. These include aircraft by Phineas Pinkham, Waldo Waterman, Bill Shulte, Glenn Curtis and Charles Freel.

Make sure to mark your calendar for May 16th so you don't let something else interfere with an enjoyable afternoon of flying wings and hanger flying.



**LETTERS TO THE
EDITOR**

12/10/97

TWITT:

Please note that I have received the parcel with the video and copies of the documents last Monday. I thank you very much for these documents.

At the moment, I am looking for some addresses in the USA. Maybe some member of TWITT can help me for that. The associations or company for which I am looking for addresses are: AIAA, SSA, US National Archives, USAF Museum, Wright Patterson AFB, Texas Airplane Factory (Meachem Field near Fort Worth, TX. These addresses will help me for the research I am doing on the flying wings and, especially, the Horten flying wings.

I have also recently sent a letter to Serge Krauss regarding his book "Tailless Aircraft Bibliography" - 5th edition (presented in the July issue of the newsletter) but I am not sure he received my letter. Do you know if this new edition was issued and can you transmit my interest into this book to Mr. Krauss?

Concerning the PUL-10 for which you presented different pictures and members comments in the July issue of the newsletter, I have noticed, with some letter exchange with Mr. Mattlener, that the main problem seems to be the financial possibilities and, also the lack of interest into this plane in Europe. I think that the European members of TWITT have to do something in order that this nice project could be more than only a project. I do not know if Mr. Mattlener has the project to attract investment from TWITT members, but it is probably one of the solutions.

I thank you as well as the TWITT members for the help and remain,

Yours faithfully,

Eric du Trieu de Terdonck
Belgium

(ed. - I apologize for getting back to you so late. Your letter got buried under some other stuff and I just came across it again. By the time you receive this newsletter you should have gotten a letter with the information you requested.

We haven't heard much about the PUL-10 in the past several months, other than they were making it a tandem seating arrangement to reduce drag and improve airflow over the propeller. When information about the aircraft was at the forefront, there seemed to be a lot of interest from flying wing enthusiasts that a kit would be available for import. They seemed to want something to build, but didn't have the designer capabilities. The PUL-10 would seem to fit their requirements, but it needs to be advertised in the aviation magazines once they are ready to start shipping kits.)

3/13/98

TWITT:

First of all, I would like to pay my membership dues due in April, as the due date is getting close.

Second, I would like to order Dennis Karoleski's video tape. Also, if you have the tapes of the Flying Wing Symposium, let me know as I would like to buy a copy or send them to me and I will send you a check.

And finally, back in the mid 70's I was very interested in building a flying wing hang glider like the Icarus II and later the Easy Riser. If I remember correctly their construction was very simple. Do you have any plans or information in your archives on the Easy Riser construction, dimensions, airfoil, etc., that I could study? I have always been interested in this design, and wonder what could be done today with a "modern" or different airfoil. I know that there are risks with this design as I actually saw John Moody try to tumble out of the sky with his powered version of the Easy Riser back at the Oshkosh convention in I think 1976. Again, let me know what you have as I know very little information (other than what I saw and remember from

many years ago) and would be more than happy to purchase anything you might have.

Keep up the good work.

Sincerely,

David Fitchette
France

(ed. - Thanks for the membership renewal. By the time you get this you should have received your Karoleski video tape, which was done at the Flying Wing Symposium. This is all I have on the actual speakers at Elmira, and Dennis has promised to send some more of his material on the speakers at a later date. I also put yours into SP format so your European machine should be able to show it.

I'm not sure what type of Easy Riser information Bob sent you, but it should have been included with the tape. I haven't heard very much talk about this design over the past several years from the membership, but maybe your interest will stir someone up.)

4/22/98

TWITT:

The TWITT/Paul MacCready meeting rolled back the years when I read about it.

I was a grade school kid again reading about Tom Swift and his marvelous flying machines and Jerry Todd and the Flying Flapdoodle. Riding down the roller coaster, Dead Horse Hill, old Stanley Steamer racing road from Leicester into Worcester, on my hard pedaling balloon tire Roadmaster bike and in reverie adding wings to it and becoming temporarily airborne.

Of watching a Lockheed Lightning fly over Malony's field and next to the field watching on a cool fall day a hobo riding an empty coal gondola car on the old New York New Haven and Hartford railroad, racing the migrating Canada geese south for the winter.

Of walking over to the new long gone Leesville pond sand and gravel pit with a school chum Richard Mamuska, where we dreamed of launching bamboo and canvas gliders that we read about in the Popular Science and Mechanics magazines; plans available from a then youthful Volmer Jensen, who was self launching in bi-planes gliders on the California hillsides and who now has found the ranks of aviation's immortals. Way back in the days of the Arup flying wings and the exciting possibilities of flying bikes.

Hope that Paul MacCready will be at many future meetings of TWITT and that we can read some illustrated articles on the Flying Telephone Pole and his bi-plane gliders, etc., and wonder if Paul and team will build some auxiliary pedal powered sports gliders?

I'd like to re-up for another two years with TWITT; hope the TWITT computer is year 2000 compliant as I wouldn't

want to be launched back to the year 1900 with an expired subscription.

Best regards.

Yours truly,

Edwin Sward

(ed. - Thank you for an enjoyable ride through a history of youth yearning to fly.

I have run a program through the computer and it says I am 2000 capable, I just have to make the date change manually, which is no big problem. Like you, I was concerned about it and took advantage of the software to check it out. So, your newsletter subscription should be safe for the foreseeable future.)

4/20/98

TWITT:

My check is enclosed. Please send me a copy of Paul MacCready's presentation.

I enjoy reading the discussion of flying wing theory. I fly an open Cirrus sailplane. It is unusual in that it was designed in '66/'67. It has an 18 meter span, no flaps, a 25/1 aspect ratio, a pudgy wing and flies well with today's ships. Why? Let me give you a hint.

The rough air redline and the airframe redline are 119 knots. Fast for the former, slow for the latter. Why? Because the washout at the tips makes them to negative above 119 knots. Schemp-Hirth built an Open Class sailplane with no flaps and a climbing airfoil by reducing the tip vortices at redline. It works until you fly with someone who can fly fast enough in strong conditions to offset your climb advantage. Still, it's a great east coast ship; and it leaves a lot of pilots scratching their heads. The washout does work.

Peter King
Signal Mountain, TN

(ed. - By the time you receive the newsletter you should have your copy of the tape. I hope you enjoyed it.

Thanks for the information on your Cirrus. Years ago my dad and I rebuilt a 1-26. With some mis-information from Schweizer, we ended up twisting the spar for the washout, when in fact it was already built into the ribs. It didn't have much of a "high-speed" capability anymore, but boy could it core a thermal and out climb the other ships at about 38 mph. For our purposes of local flying it worked well and, it eventually went on to win several 1-26 nationals events even with the "defect.")

3/20/98

4/23/98

TWITT:

TWITT:

Enclosed is a picture of a flying wing from Peter Bowers book, Guide to Homebuilts, 8th edition, page 36.

Answering page 8, April '98 issue, of course, the system described is suited for prototypes and far from being ideal for ever-lasting Piper J-3s and hard working RV or Kitfoxes.

It was called the MB-1 Delta Kitten and was designed and built by Marion Baker of Huron, Ohio. The plane flew successfully for several years, but unfortunately crashed in July 1976 killing Marion.

It is cheap, fast and light. And, progress is on the way for facing cover and protection.

Marion was also working on a two-place version called the Delta Tiger.

Abuses have put their toll on the prototypes; two crash landings; three lateral wreckage's of the trailer with the proto packed over it (120 pound trailer, huge volume and strong lateral wind makes this transport tricky). They are still operative with some wrinkles, bumps and additional tape.

Does anyone have any information about either plane? If so, please pass it on to myself and TWITT. I'd like to build one and I'm sure some of you would too.

Thanks for all your excellent job.

Sincerely,

Alain MIROUZE

Bob Bigelow
9005 Talisman Drive
Sacramento, CA 95826
(916) 364-8309

(ed. - Thanks for the additional insight into your building techniques.

(ed. - Thanks for the picture. It should work okay in the newsletter since it is in black and white so everyone will have an idea of what it looks like. Many times a picture will jog a memory where the name of a one-of-a-kind doesn't mean much.

This issue includes some of the photos you sent along last month on these techniques. Hopefully, everyone will get a better idea of how you go about putting together a prototype to test various theories of fly wing flight.

The most pointed question is why did it crash and was it something in the design that needs correction or perhaps pilot error? Since it has been so long and apparently no one has built another one, it is something to consider unless you already know the answer.

One thing that is prevalent throughout your work is that it involves low aspect ratio wings. Have you found over the years that this is the best solution to the type of flying you want to do, that is, slow speed slope soaring in perhaps marginal conditions from the low hills around your home town? If so, how do you feel about these building techniques being used for higher aspect ratio aircraft that might get into stronger lift from thermals or mountain slope soaring? Is there another building technique that could be applied for this type of aircraft that you may have experimented with in the past?

Anyway, hopefully, someone will come forward with the information you are seeking.)

Again, thanks for all the information over the past several years. I'm sure others have enjoyed it and are amazed at what you are constantly doing.)

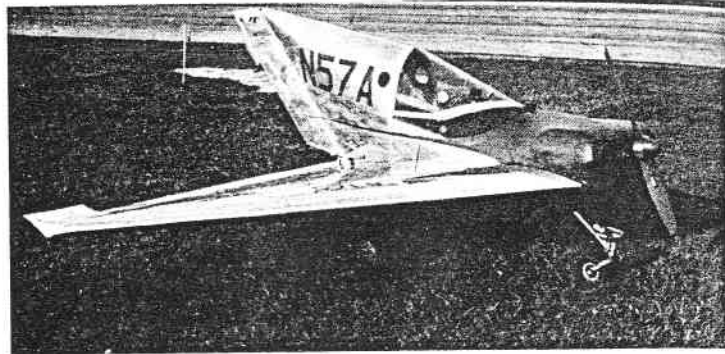


Fig. 4-2. While most homebuilts are conventional designs made from purchased plans, some capable builders develop unorthodox configurations on their own. This is the all-metal Baker "Delta Kitten," one of the very few successful propeller-driven delta-wing designs.

PROTOTYPE BUILDING

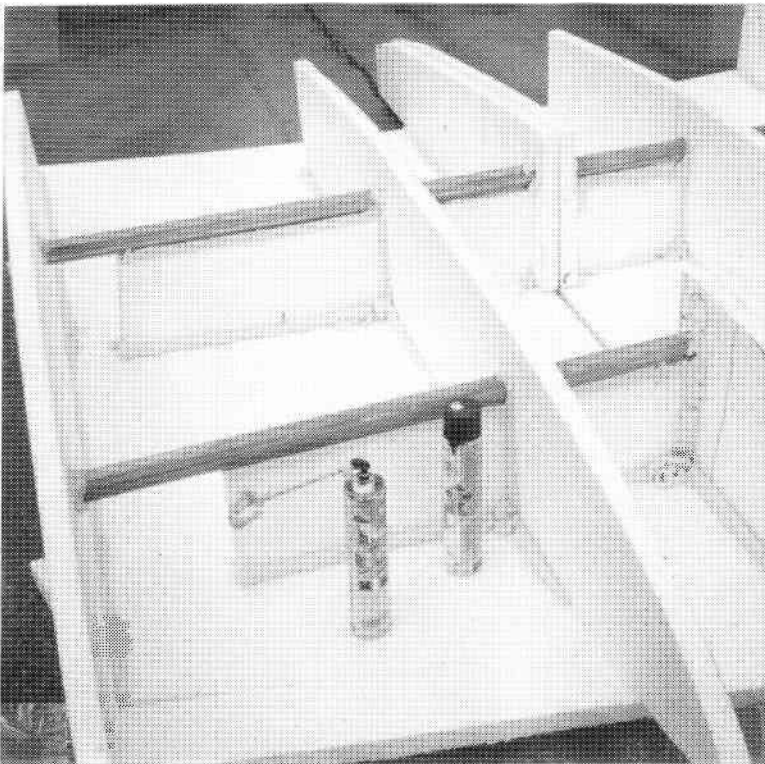
As indicated last month (and you didn't see) there was supposed to be some of Alain Mirouze's building techniques shown in the newsletter. It turned out there wasn't room to fit the material he sent along on computer disk, but this month we will include everything he provided in the package.

You just read part of his philosophy with the prototypes and hopefully I have picked just the right pictures from the many he sent to give you a flavor for what he does to put and project into the air. It obviously looks very rough, but within the context of the type of flying he is doing and what he is trying to accomplish at the time, it seems to work very well for him. It is offered here as an alternative to some of the more traditional ways the modern builder goes about developing an particular design through the various

stages of prototyping. These techniques look like they could apply equally to both the full size and modeling worlds, so it should be of value to most of the membership.

The following is just as Alain wrote it with editor's notes in the parentheses trying to describe what was in the picture not shown.

Beginning: just a form on floor (the floor became the full size drawing board for the basic shape of the aircraft). Then: cut the ribs (shows the stack of cut ribs, but not how they were produced - sawed or hot-wired). Holes in the ribs (these appear to be for the tubular spar - use of a very basis hole making tool - aluminum pipe with toothed end and a T-bar across the top to act as an apple corer would). Begin to foam in place (picture shown below).



Notes - Polystyrene foam cores into two grades: expanded (cheap, but neither very hard nor easy to finish), and extruded (blue or yellow). They may be replaced by rigid polyurethane foam if fuels may come in contact. Polyurethane pressurized foam is used for insulation and filling. Leave 1/6 inch of space between parts to be foamed. Cut excess after hardening (4 hours).

Begin to cover by foaming blocks between the ribs (picture shown at top to the right column).

Instruments used and closing of the volume at leading edge (typical wood working clamps to hold the foam in place with an aluminum tube leading edge foamed into the top and bottom "skin" apex. Also shown a regular

cross-cut saw and long blade from a hack saw used to make the initial shaping cuts - nothing exotic here folks).

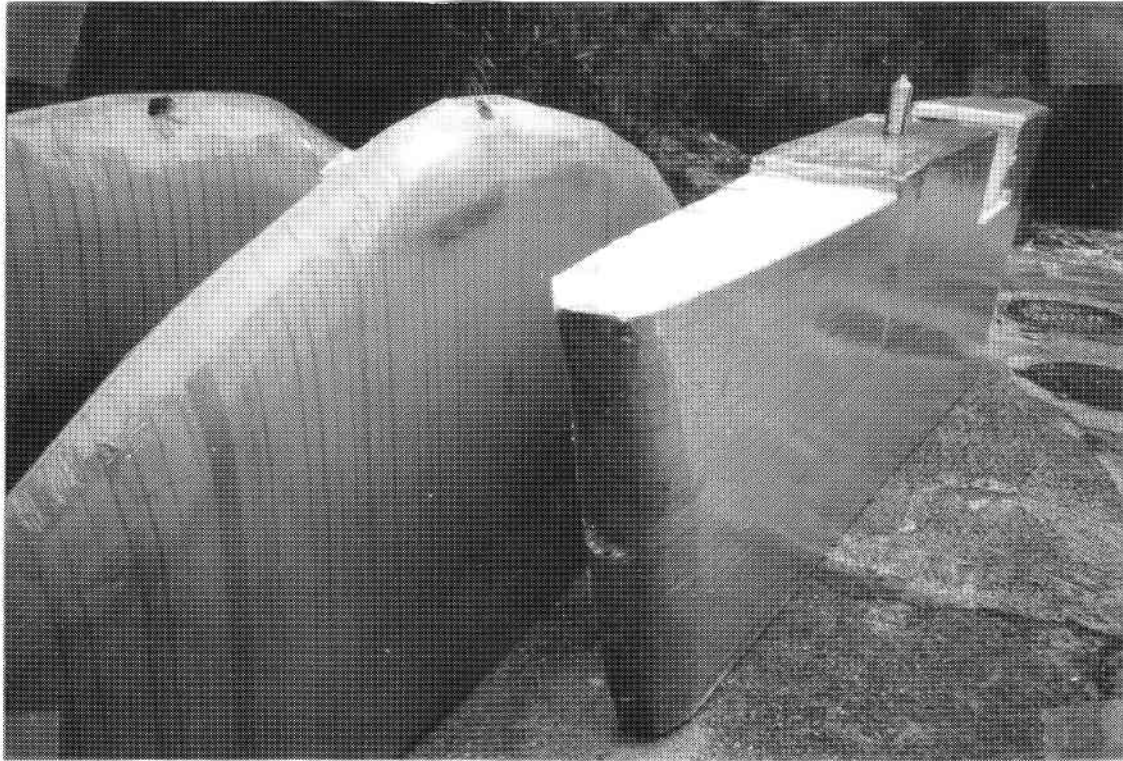


After shaping - metallic brush, then sanding with grit paper - secure control surfaces hinges with reinforced strips of adhesive tape later covered by normal adhesive tape (similar to modeling technique - aluminum tube sections are attached to the trailing edge of wing and leading edge of control surface so a smaller tube can be inserted as a hinge pin). Covering it (the surface is literally covered with overlapping runs of what looks like plastic adhesive tape - again nothing exotic here but very functional and easy to recover after a repair).

Each part is about 4 feet wide in order to make transport easy -!! (the aircraft is composed of four 4' longitudinal sections connected together with a series of aluminum tube spars which look like the go all the way from tip to tip and are secured to prevent the sections from coming apart in flight - a nice feature I would think). [see picture at top of next page]

This prototype has been realized in just 60 hours, \$200, weight is 70 pounds - might be less with more work and dollars for a 17 foot diameter (pictures show the finished product all assembled, including a vertical fin with no rudder. Elevons have control horns mounted on top, inboard ends, but there was no way to tell what type of connection was used between them and the cockpit area or how they are mixed to provide total control authority).

The monster atop a car - it now has a trailer which is better (you recall in mentioned lateral damage from transporting it. The stack on top of the car was higher than the car was tall - looks very top heavy other than it



New half-size inflatable core (seen below is an inflatable version made up of concentric circular tubes that create the symmetrical airfoil along its entire diameter with a pilots hole about half way back from the leading edge).

The same, dressed in early experiments (the inflatable is covered what looks like a nylon bag that contains the inflatable control surfaces which are activated with hand-held control cables).

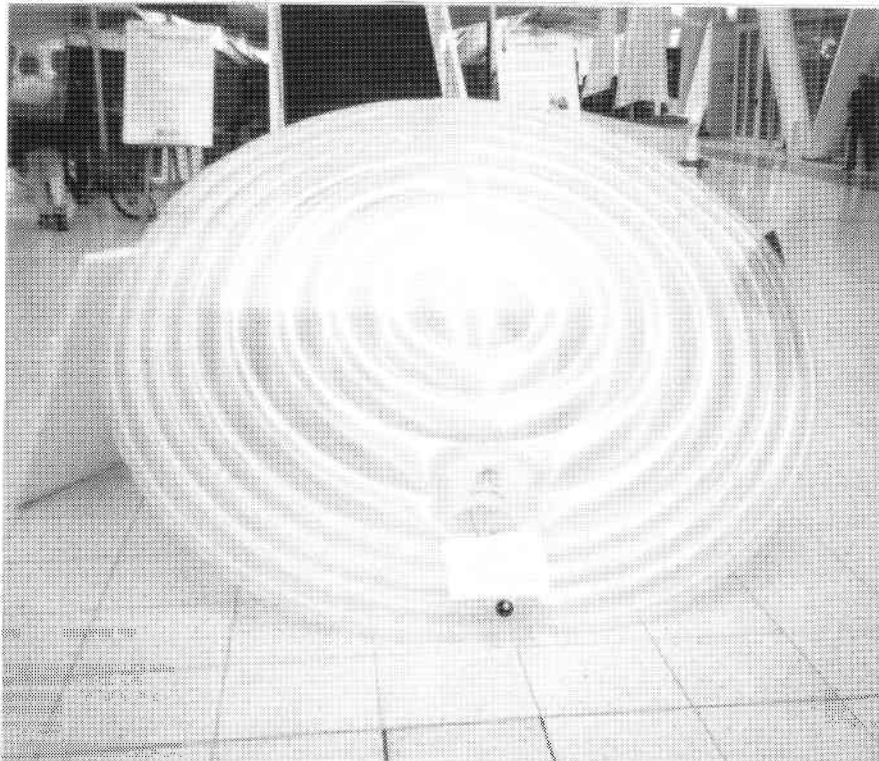
Picture shows unmanned flight as part of initial flight tests).

only weighs 70 pounds - but there is a lot of wind resistance and side area that could make traveling in cross winds extremely difficult).

[See picture in top, right column of next page.]

Engine (ROBIN) fixation by epoxy resin and fiberglass rope obtained with manual pultrusion method (two cylinder, air-cooled engine attached to upper and lower aluminum tube longerons using exactly like what he called it, epoxy resin and fiberglass rope - two heavy strands of rope go between the longerons to provide torsional stability of the actual engine mount portion. Looks like sleeves are placed in the rope structure to allow for the engine mount bolts).

The pictures shown below are more illustrations of Alain's construction techniques. He also sent along some text material to help explain parts of what you are seeing here. It also contains additional construction details and not all the figures cited in the text were included on the disk. This sort of supplements what's in the pictures shown above and will give you a little more detailed view of the procedures he goes through to join the foam parts.



NEW CONSTRUCTION MODES
("MIROUZE's Foam'n tape")

By :Alain MIROUZE (address: LE SYLVACANE, 13127 VITROLLES, FRANCE)

It is now possible to build cheap, light, and fast.

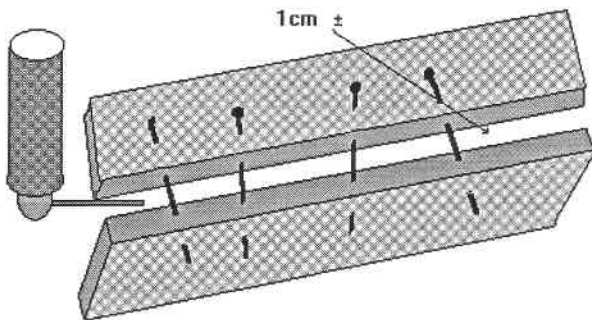
THE PRODUCTS:

- Aluminum tubing (ex-hang gliding if available). Polystyrene foam (house building and repairs) in pressurized cans.
- Polystyrene foam: either blue, green (extruded) or even white (expanded). This polystyrene foam may be substituted by either PVC foam ("Klegecell"*) though more costly, or by polyurethane rigid foam (in areas likely to be attacked by gas or oil).
- Adhesive reinforced tape (or even normal one, from packaging industry) or adhesive film, glass fiber reinforced or not.

METHOD:

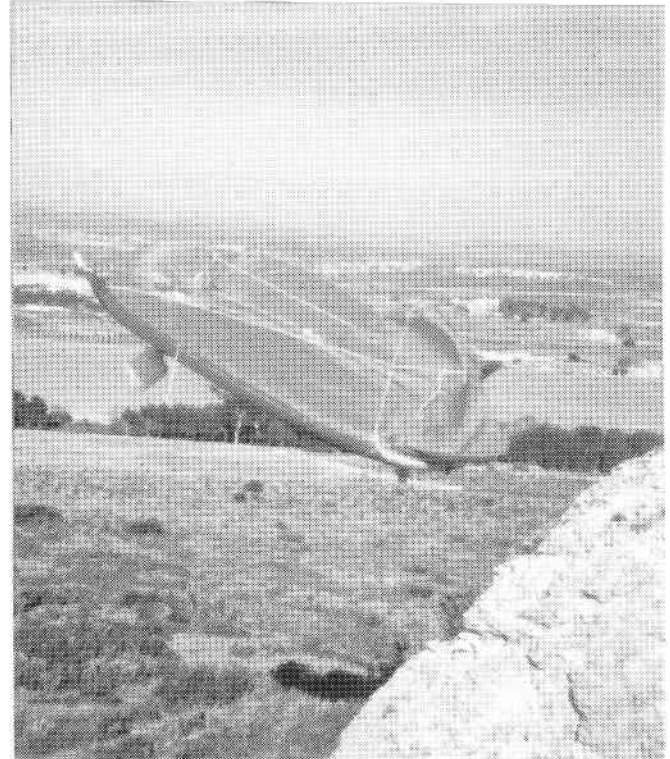
See fig N° 1 & 2: After placing with enough accuracy the aluminum tubes and foam blocks, polyurethane foam is injected in the 1 cm gap between these elements. Care must be taken to depolish the aluminum, and to calculate the foam blocks volume in order to be in excess volume regarding the final shape. This structure has to take all compression forces. Over this shape will come adhesive reinforced film (tape, generally) taking pull forces. This same film gives the surface finish and enough elasticity to allow for ordinary local shocks to be suffered without damage.

Fig N° 2



PRACTICALLY:

Where concentrated efforts are localized (engine, landing device, spar), ordinary techniques will be used (see below, also, the poor man pultrusion method). In between, use reinforced aluminum tubing (sleeves, or other) which will transfer the efforts. As seen in fig N° 2, long nails or big wire can hold the components in place waiting for the foam to harden (1 to 4 hours according to humidity and thickness). When all the blocks are foamed together, shaping is easy following the method:



- The main task is done with either a band saw or a hot soldering iron (care must be taken not to go too deep, care...)
- Then, the best tools are a set of metallic brushes (yes, and strong, and of different shapes). With them, it is easy to get all the complex shapes quite accurately.
- Finishing is done quite classically with grit paper.
- Clean thoroughly (vacuum). However, one of the drawbacks of the method is that it is impossible to surface the hollow areas with adhesive tape: it would shrink and come unstuck. Even large flat areas are not very suitable for this building system, unless by holding the tape here and there with some system of gluing (epoxy spots used as rivets). We are waiting for new adhesive polystyrene foam compatibles. If the cover is correctly done, paint (yes, why not?) can be sprayed, and even some gasoline spilling will not attack the substrate.
- One good way of protecting the foam without adding weight, if no film is to be put over it (inside hollow surfaces), is to coat it with modern water-based glues (wall papers) or, best, polyvinyl based paints (here, though weight may become a problem).
- Rigid polyurethane foam, which is quite solvent-resistant, is not suitable to be covered by adhesive film: the micro-surface to be in contact with the film is too small.
- It is necessary to carefully (mind the weight, though!) "paint" it with some latex-based (neoprene) adhesive.

STRENGTH AND AGING:

One test probe was subjected to a 200 Km/h speed without any problem(except escape radar's on French highways). Some experimental ultra-lights and free gliders have suffered many shocks and, for the latter, crashes, with no or only minor damages, quickly repaired (cut, discard, place block, foam, shape, cover). One of the first structures done this way has now been 15 years in a hot dry place: covering tape and film would have to be removed, nothing else. In fact, if tape (more so than film), is used without protecting paint, repeated weather aggression, rain, frost and sun, will deteriorate the cover quite rapidly (six months outside in the open). If correctly used, the whole system is not very prone to flutter due to the small weight of the elements.

PRICE:

A prototype glider (small aspect ratio, so no problem with spar) has been realized at less than 800 dollars

WEIGHT:

Basic structure can average less than 1 kilogram/square meter (then, of course, add engine, accessories, landing gear, cockpit, and so on).

BUILDING TIME:

A frame can be done (except..., see above) in six days; a wing in two (if spar is already available). Changes are easy.

CONCLUSION:

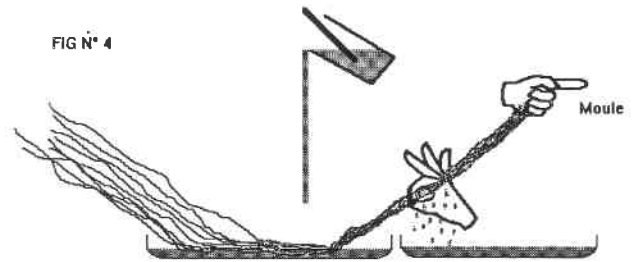
No, it is not the way to build a Lançair or a White Lightning. But, in the world of ultra-lights, and also for some prototypes, this is a very good solution

PULTRUSION MADE EASY

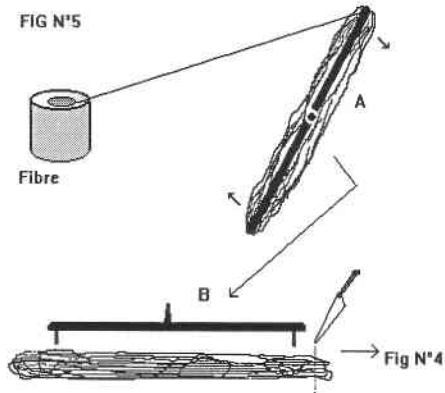
(By Alain MIROUZE, Le SYLVACANE,13127 VITROLLES, FRANCE)

Pultrusion (contrary of "ex-trusion) is not the privilege of huge companies any more. First of all, learn to work with epoxies and fibers . You also need pure monodirectional fibers coming in reels many miles long: you need to prepare your skins according to Fig N° 5. Then refer to figure N° 4:

-Your epoxy is already prepared in a can (half bottle cut lengthwise)



- Your (glass) fiber lies along in finger-sized (1) skins, of a length matching to the size of the piece to be realized.
- Your hands protected by good gloves.
- A mold of the desired shape: it is possible to use polyethylene hoses (not PVC) cut lengthwise to make very strong rods of complex shapes
- Now, action!: With one hand, you dip the beginning of your skin into the epoxy and, when wet, you pull it, squeezing it into your other hand.



Resin flows along, wets the remaining part and, by the end, you get the best proportion of fiber and resin. This sticky snake is then laid along inside your mold. Easier to said than done. Many such manipulations may be necessary. Excess resin (not cheap) falls everywhere. After a few moments, gloves stick to everything except where you need them. The operation lasts longer than programmed, and the epoxy begins to polymerize (2). You have not enough volume to fill the mold (Hard luck...!). And nothing to say about your comments when opening the mold...

- Your first experiments may be far from rewarding. But mastering this technique allows you to enter into a new efficiency world. (1) If bigger, it is difficult to "wet" them. (2) As a last resort, it is possible to water the mess, you will get a thin whitish surface (to be sanded off later), the inner part remaining OK.