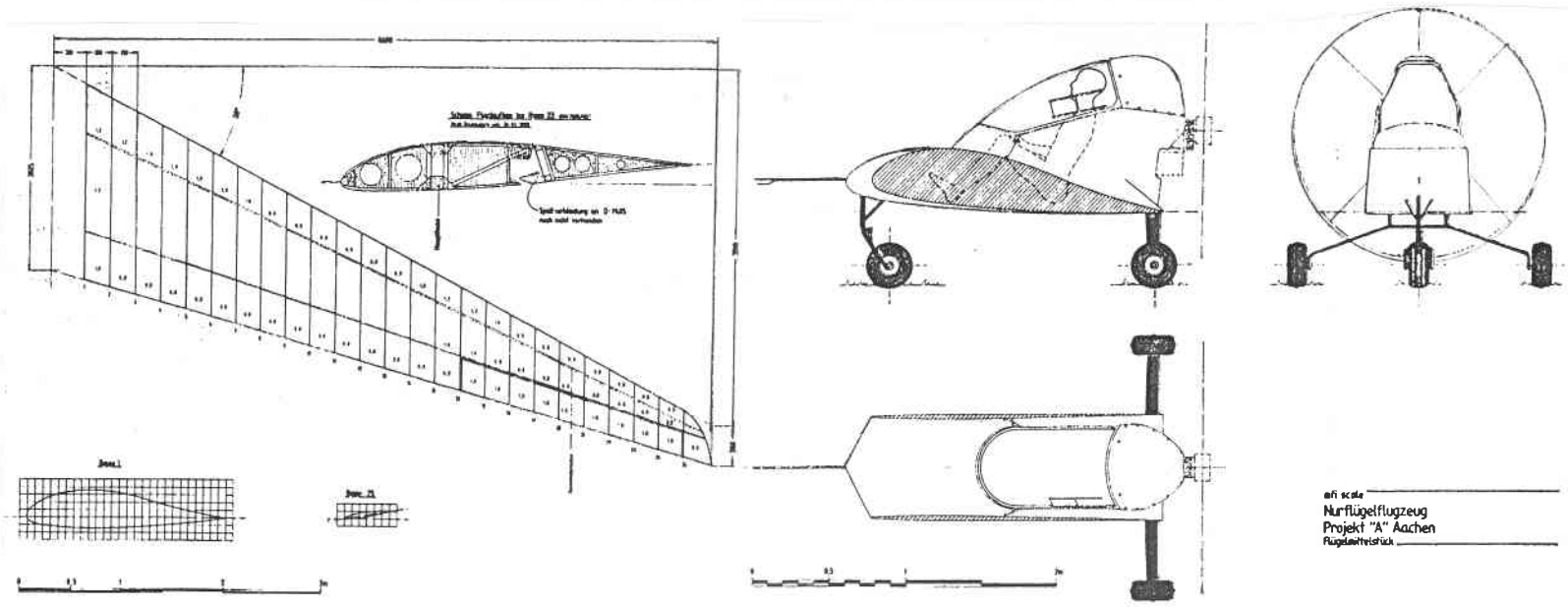
No. 131 MAY 1997

# T.W.I.T.T. NEWSLETTER

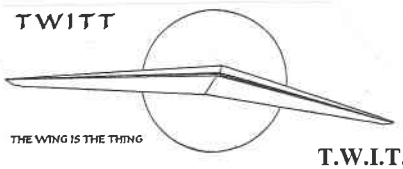



**PROJECKT AACHEN** - Designed by Ulrich Schafer with the help of Reimar Horten. These drawings were provided by Philippe Vigneron all the way from Saudi Arabia. Last month we showed a 3-view on page 6, and these are some of the schematics that were included in the article published in the Modellflug International magazine, April 1996 issue, pp. 40-46. See page 3 of this newsletter for the specifications on this aircraft.

**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., **9705** means this is your last issue unless renewed.

**Next TWITT meeting: Saturday, May 17, 1997, 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.

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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)**
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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

I hope everyone enjoys this issue of the newsletter. It has some interesting material, what with the completion of Robert Osborn's article on the Airwave Concept and the initial installment of David Fitchette's translation of the French article on the Choucas. I have also thrown in a little bit of the type of information that is floating around the nurflugel mailing list, which I will do in the future as small filler pieces.

For those of you on the east coast, and others with healthy travel budgets, don't forget the upcoming SHA Eastern Workshop on July 17-18 at Harris Hill. The 17th will feature a symposium on flying wings with material being presented by Al Backstrom and Jim Marske. There will also be some other interesting presentations by flying wing enthusiasts who have been last minute add-ons to the program. It seems to be shaping up to a fine day for flying wing nuts if you can get there. I will try to get more detailed information from Bruce for the June newsletter.

The exposure we are getting through several internet web site links has resulted in some new members and several inquiries from potential members. I am hoping to put together a home page for TWITT by sometime this summer which should help increase our exposure even more. Our basic membership information has been added to $B^2$ Streamlines home page and it is also linked through other sites, and we thank all of them for their assistance.

One of the things that may become possible with a TWITT home page would be an electronic newsletter. This would allow members with access to a special section to get their newsletter the instant it was published versus waiting for the snail mail to arrive. My initial thoughts would be to come up with a price that would help offset the cost of maintaining the web site, and one that would be less than the mail subscription. If any of you are interested in this type of approach, please drop me a line so I can start getting an idea of how much support there is for such a venture.

I hope all of your favorite flying wing projects are moving along at the pace you would like and that you will be in the air as the summer arrives.

Andy

## MAY 17, 1997 PROGRAM

This month we will be catching up on a program from last year that didn't happen as expected. **Gene Larrabee** is coming back to do his "Lecture On Propeller and Analysis" program. We have asked him to modify his presentation somewhat to include how some of the things he will be telling us can be applied to flying wing applications. This should make for a good program and give some of our members who are currently working on projects some valuable insight on how to setup their powerplant and propeller combinations.

Rather than go through Gene's background again, the following is some of information he provided about his lecture.

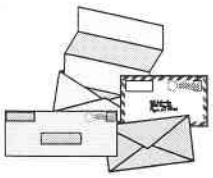
Propellers are essential for low speed flight. The theory underlying their design goes back to 1919, when Albert Betz and Ludwig Prandtl wrote a paper on propellers of minimum energy loss. Sidney Goldstein revised their theory in 1929. Gene devised a simplified version in 1978, which was used with great success on the CHRYSALIS and GOSSAMER ALBATROSS human powered airplanes.

The theory is an adaptation of Prandtl's lifting line wing theory, which accounts for the helicoidal nature of the trailing vortex sheets shed by each propeller blade. The "slip" of propellers of minimum induced loss is shown to be radically constant, and accounts for the axial and swirl components of the "inflow" or induced velocities. A certain radial lift distribution on each blade is required to fulfill the minimum induced loss condition. Gene's simplified theory brings minimum induced loss propeller design to the point where it can be done with a pocket scientific calculator such as the HP-15C.

In 1979 Gene and Susan Elso French wrote a program, HELICE, which incorporated these ideas. It could be used to design minimum induced loss propellers and windmills, and to analyze their off-design performance and that of rotors or arbitrary geometry. In 1984, Mark Drela wrote a more exact program called XROTOR, and many others such as John Roncz, Hepperle and Aerovironment have developed related programs.

Gene worked for Curtis Wright after graduating from college, and then became a professor at the Massachusetts Institute of Technology. After retiring from MIT, Gene moved to California where he worked for the late Dr. Julian Wolkovitch on joined wing aircraft, and also taught aerodynamics at the Northrop Institute. He has just completed a book on stability and control in partnership with Malcomb Abzug.

Mark this one on your calendar and be sure to come on Saturday for what we know will be delightful and informative program. The group has enjoyed Gene's talks in the past and we expect this one to be just as good.



## LETTERS TO THE EDITOR

4/15/97

TWITT:

Enjoyed very much your reporting of Jack Lambie's expert, pasture, cow flap landing; reminded me of the old saying, "If I don't see your in the future, I'll see you in the pasture."

So back to the pasture; The Complete Book of Hang Gliding, by D.S. Halacy, Jr., Hawthorne Books, 1975, pp. 115-118 has some ultra light dream craft of the time that Richard Miller and Jack Lambie had foreseen. Miller's dreamship was named Thistledown with a remarkable 38:1 glide, and Jack Lambie, designer/builder of the pioneering Hang Loose, foresaw sleek self-launched hang gliders that will fly for hundreds of miles.

Courtesy of Mark Lambie; Ground Skimmer, Jack Lambie's equivalent of Thistledown, would be built of an exotic material call "unattainium". Two decades later such ultra light gliders are flying and Richard Miller's and Jack Lambie's Thistledown type of dreamships are on the near horizon.

So back from the pasture to the present, I've enclosed my subscription renewal for another year of TWITT, or I'll be left in the pasture without any future TWITT newsletters.

Thanks and best regards to you.

Yours truly,

Edwin Sward

*(ed. - Thanks for some interesting insight into our latest speaker's past dreams, and to a former TWITT editor's (Miller) vision of the future. Also, thanks for you renewal and enthusiasm for TWITT.)*

---

March 29, 1997

TWITT:

Please find herewith me renewal, very sorry for the delay and **thank you very much** for keeping me on the list for the newsletter after the deadline. As with so many things in this country, IMO's are quite difficult to do and I had to wait for a friend with a bank account in the States in order to be able to send you a check in US$.

I have included with this letter some information on two recent European tailless aircraft.

The first one is the PROJEKT AACHEN, designed by Ulrich Schafer, with the help of Reimar Horten. The wings are in wood and the fuselage in steel tube and fiberglass. This little wonder has made her first flight on January 1, 1995.

| | |
|---|---|
| Span | 15.97m |
| Area | 13.13 sq m |
| Empty Weight | 195 kg |
| Max Weight | 300 kg |
| Engine | Gobler-Hirth 36 hp |
| Cruise Speed | 110 km/h |

For more information please contact: Christiani Wassertechnic, Heinrich-Heine Strasse 15, D-52249, ESCHWEILER, Germany Fax 02403/51468.

The second one is the CHOUCAS designed by Claude Noin. This two-seat aircraft is quite similar to the Fauvel AV 221/222, but with a more modern airframe in fiberglass, carbon fiber and foam. It seems that this aircraft is proposed as a drawing set (in that case, the wings are in wood with some components in fiberglass) or as an advanced kit (wings in composite materials), or even as ready to fly. The first flights have been done in the spring of 1996 and certification is underway.

| | |
|---|---|
| Span | 14.35 m |
| Area | 21.30 sq m |
| Empty Weight | 280 kg |
| Max Weight | 530 kg |
| Engine | Rotax 503 50 hp |
| Cruise Speed | 130 km/h |

For more information please contact: Claude NOIN, Aeropole, 05130 TALLARD, France, Tel/Fax 492.54.00.99.

On my side, I am looking for information concerning the ultralight gliders designed by Catto, Kiceniuk and the Klingberg K-Wing (ref. TWITT news-letter #44, page 3). Please, perhaps some members can help me (3-view drawings, main data, etc.)??

Also, did you receive any information concerning the Lippisch style air-craft, whose photo was issued on the front page of the #106 newsletter??

Sorry again for the delay.

Best regards from Saudi Arabia

Philippe VIGNERON

*(ed. - You will be receiving this newsletter and #130 where you will see that Serge has already sent in some of the information on Projekt Aachen and Choucas, although it didn't include the statistics. This issue will also feature part of the English translation of D. Fitchette on the Choucas.*

*We will dig into the library a little and see what we can find on the designs you are interested in. As for the aircraft on the cover of the April '95 newsletter, I asked the mailing list group and found it was built by Gerald Geske in April 1983 and is called the Moth Bat. He is the one who sent in the picture, but apparently no specific information to go with it. He is still a member and perpaps when he reads this he will write us again telling us a little more about this interesting looking design.*

*Finally, I hope we have everything up to date on your subscription so please double check the expiration date on your label to make sure it is what you think it should be, and thanks for sending the various pieces of information.)*

---

March '97

TWITT:

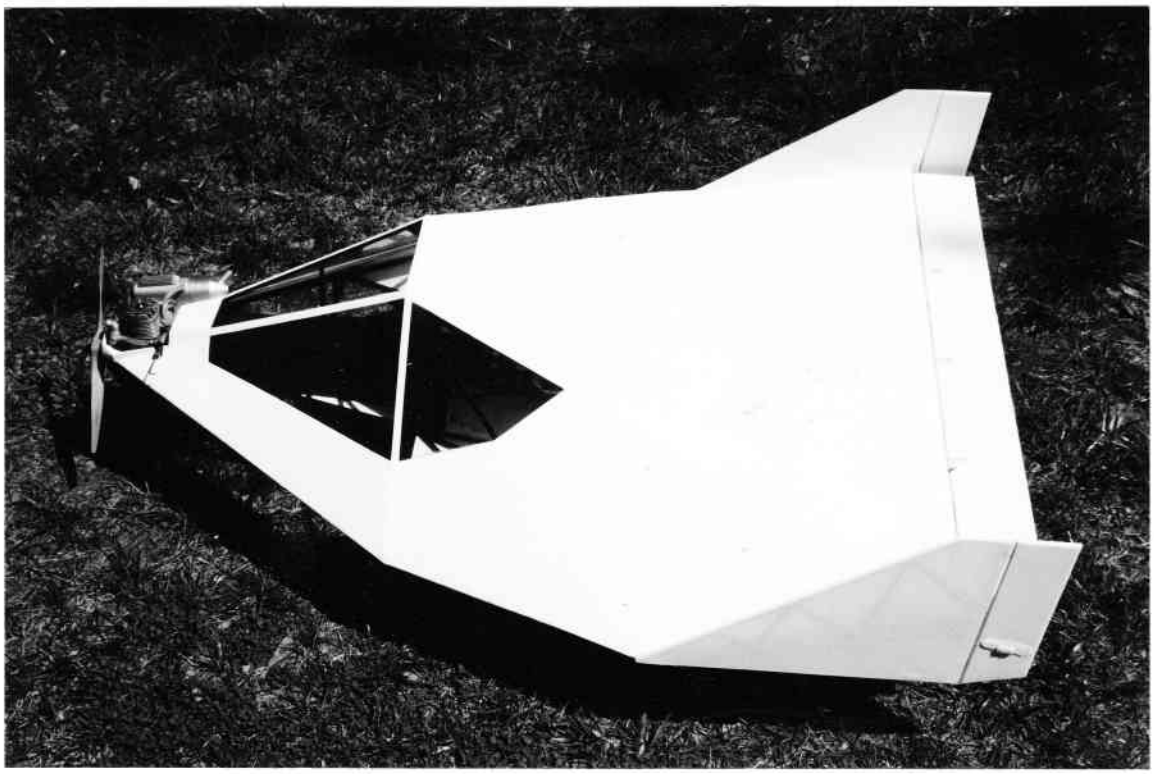
Two items, first, page 2 and page 10 of my copy of the No. 130 newsletter did not get copied. Like blank!! If you could send me a correct copy it would be appreciated. Thanks!

Second item, please find enclosed a couple of snap shots of my most recent project (see above for one, next page for the other). It is a 1/6th scale of Mr. Wainfan's Facetmobile

FMX-4. It now has 2 successful test flights. It flies OK, but since it came out a little heavy, it glides about like the space shuttle! It is powered by an OS .25 cu.in. engine and weighs in at 3 lb. 12 oz. with an empty tank. Thanks for helping me get in touch with Mr. Wainfan.

Thanks,

Robert Higgins
Grove, Oklahoma



*(ed. - If Bob hasn't already taken care of getting you a new copy of No. 130, I will push him along with it.*

*Thanks for the pictures of your Facetmobile model. We didn't have time to get them half-toned, but it seems if we use the originals they will come out well enough to show off the lines and general layout of the model.*

*We haven't heard very much more about the Facetmobile since Barnaby came down and gave us his presentation. If you have any insights about his continuing work that helped you design the model and get it flying, we would like to hear about them.)*

## VISITOR FROM ARGENTINA

*(ed. - On April 19th, we had the pleasure of meeting Juan Mascarello, and his wife Rosa, at the TWITT hanger. He was brought there by Ladizlo Pazmany since he knew Juan is a flying wing enthusiast, and Paz did some Spanish/English translation for little while. I took Juan and his wife back to their hotel later in the day and Juan gave me a large amount of Horten material he had copied from his archival files, including some color pictures of what remains of some of the Horten aircraft.*

*I have since turned this material over to Phillip Burgers because the vast majority of it is in Spanish. Phillip will also be going to Argentina in May and plans on spending time going through archives in the town where Horten lived in the hopes of coming up with even more unique material.*

*Juan joined TWITT on the spot, and we hope to see more Horten material come out of Argentina through him in the future.*

*Phillip got a chance to talk with Juan before he left town to go see the Horten IV and N9M at the Planes of Fame Museum in Chino on his way back home to Argentina. Below is a recap by Phillip of this conversation.)*

TWITT has a new member, Juan Mascarello, who has visited us from Argentina. He is an aerospace technician and working at Austral, a local Argentinian airline. He has extensive experience in aviation mechanics and structures, and also is an avid Horten follower. Juan has gathered information on Horten's designs while visiting Dr. Horten's family in Argentina, and Mr. Uden in Germany. He has brought us pictures of a flying wing, presumably a Clen Antu, a two seater flying wing designed by Horten in the 50's in Argentina and stored at Juarez Celman's airport located in the province of Cordoba. Unfortunately, after forty years it does not look in the best of condition. What a wonderful project this would be for TWITT to restore this flying monument!!! (ed. - I understand this is the Horten designed glider flown across the Andes.)

Juan has also shared with us the predesign data of a flying wing of his own called the JM I Nova. He is estimating his first test flights to be performed sometime early in 1998. and we wish Juan much success with this project. Some of the characteristics of the JM I are:

| | |
|---|---|
| Span | 24.6' |
| Area | 76.6 sp. ft. |
| Empty Weight | 198 lbs. |
| Max Weight | 418 lbs. |
| Engine | Rotax 40 hp |
| Max Speed | 108 kts |
| Wing Taper Ratio | 0.26 |

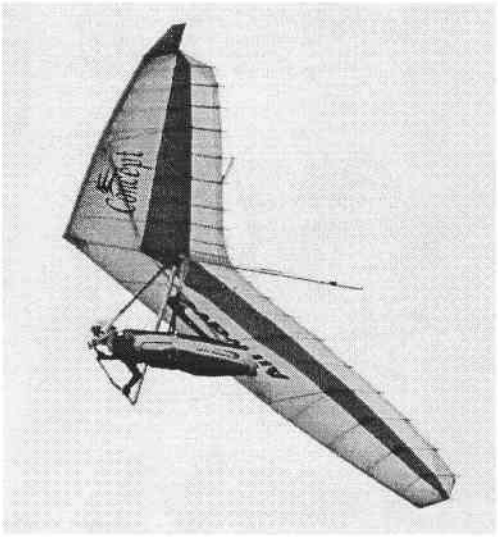
Juan also passed along some articles related to Dr. Reimar Horten's activities that he has copied for us from Argentinian magazines. Some selected articles will be translated into English and published exclusively in our TWITT newsletter in the near future. Stay tuned....

We are very happy that Juan has visited us and shared this wealth of information and welcome him as a new member, representing such a strategic country as Argentina, where there are so many surprises in the form of uncovered treasures belonging to a once very productive era in flying wing design.

## The Development of the Airwave Concept.

by: Robert Osborn MEng (Oxon)

*(ed. - Last month we published the first part of this original article by Robert Osborn. His lead in to the article included the statement, "I hope to provide a few insights into how it (CONCEPT) was developed, and explain a little of the theory behind the improvements in handling, climb and glide." With that in mind, here is the remainder of the article.)*



**New Profiles: *lower twist, lower drag and lower stall speed***

It is well known that excessive washout destroys high speed glide; see ***twist induced drag*** in Figure 1. Throughout the development of hang gliders, designers have striven to reduce washout to a minimum. The traditional method has been to increase sail tension, however, this has the undesirable effect of locking up handling. Furthermore, the action of reducing washout compromises pitch stability. The solution to both these problems proved to be elegantly simple. Airwave designed new profiles which moved the centre of pressure further forward, reducing the twisting moment about the leading edge. As a result the trailing edge sits lower, without the need for high sail tension, and since the new profiles are more stable, less washout is required to maintain stability. The first sets of the new profiles improved the handling and performance, but had the side effect of a sharp stall when the glider was wet. This problem was solved by sculpting the profile shape with the aid of aerofoil modelling software. The final profile was not only better in the wet, but also stalled at a higher angle of attack and maximum coefficient of lift. The combination of higher maximum coefficient of lift and the increase in lift at the tips due to lower washout, has resulted in a lower stall speed.

The success of the new profiles at delivering improved performance, handling and stall characteristics presents the question of whether they would produce similar results on a conventional glider with luff lines. In fact, similar profiles have been tried before, but the gliders suffered from poor handling and stall characteristics, without any increase in performance. Why? Because the luff lines cut in. Lowering the luff lines would have offset these problems, but at the expense of pitch stability. It is only in combination with *Spare Ribs* that these gains are realized.

**Wingleted wing efficiency**

While reducing parasitic, profile and twist induced drag improves glide at higher speeds, the effect is less significant at lower speeds. To achieve better efficiency at lower speeds the designer must reduce ***lift induced drag*** by increasing span, or by increasing span efficiency. Increased span has been tried, but the theoretical gains have often been lost by the unavoidable increases in washout. Furthermore, the handling on such gliders has left a lot to be desired! Airwave's winglets increased span efficiency, and the Klassic proved to be one of the first production gliders to have low enough washout for them to be effective. Although these performance gains were modest, the improvements in yaw stability and turn coordination made them a valuable addition. The Concept has even less washout, increasing the load taken by the tips and the effectiveness of winglets in reducing ***lift induced drag***, while maintaining all the original improvements to handling.

**Glide performance: *Four ways are better than one***

The prototypes which evolved into the Concept reduced drag in four ways; 1) removing the parasitic drag of the

luff lines, 2) reduction in profile drag by using more efficient profiles, 3) reduction in twist induced drag by lowering washout, 4) reduction of lift induced drag by virtue of winglets and reduced washout. The fully topless prototypes also offered a further reduction in parasitic drag. To assess progress Airwave carried out side by side glide tests, between a `race' tuned Klassic, the `sans' luff lines prototype and the fully topless prototype. Both prototypes demonstrated a clear advantage over the Klassic at all speeds. However, the difference between the `sans' luff lines prototype and topless prototype was relatively small. The additional cost of producing a carbon fibre spar could not be justified by the marginal performance improvement. The `sans' luff lines design was by far the most cost effective way to bring significant improvements in performance to the market place.

The ultimate test for any glider comes in international competitions, and the Concept has proved itself, out performing the `race' tuned Klassics, and also the best production gliders of other manufactures. In the European Championships, even the worlds top two pilots on their topless prototypes could not outclimb or outglide the Concept. Competition successes have included winning the Morningside glide test with an average glide ratio of 12.62. While this figure is impressive, it is probably an overestimate of what a typical pilot will achieve in still air and away from ground effect. The author expects, from theoretical considerations and side by side glide tests, that the Concept has improved the best glide ratio by at least 5% over the Klassic. From this estimate, and assuming that a typical modern performance hang glider, such as a Klassic, has a glide ratio of 11.5, at 27mph, a sink polar can be drawn, see Figure 3.

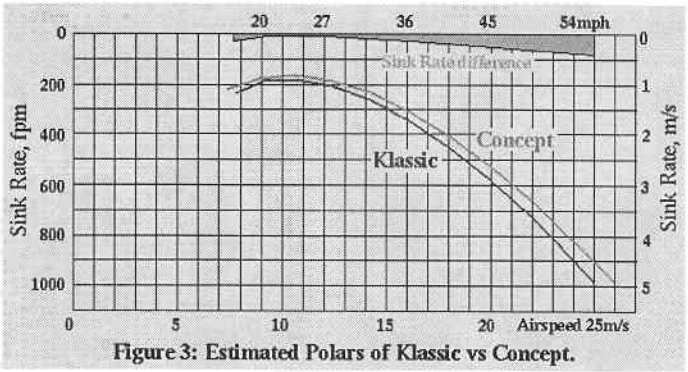


Figure 3: Estimated Polars of Klassic vs Concept.

**Climb performance : *guaranteed not to get you in a spin***

The last area of the glider's flight characteristics, handling and climb performance, naturally fell into place once the other areas of its design had been optimised. Despite the small amount of time required to perfect the handling and climb performance, the advances in these areas are possibly more significant than those achieved in straight line flight. Particularly improved are the low speed roll authority and spin resistance, not because of any clever new design feature but by removal of the aspects which had previously been hindering them i.e luff line interference and excessive sail tension.

While luff lines are designed to cut in at low angles of attack for pitch stability, they also can cut in when large amounts of billow shift occur. When they cut in they produce a reflex section, which increases drag, dumps lift and pitches the nose up. At low speeds, a large amount of billow shift is required to assist weight shift in rolling the glider, with the inside `loaded' wing washing out, and the outside `unloaded' wing washing in. As the trailing edge on the outside wing lowers, it becomes susceptible to the luff lines cutting in. If they do, the outside wing will suffer a loss of lift, and an increase in drag, causing the glider to roll and yaw away from the intended turn. This will be felt as strong resistance to initiating a turn, or the `locked out' feeling when trying to prevent a wing being lifted by a gust. On a conventional glider the pilot has to speed up to maintain roll authority. Whereas, on a glider equipped with *Spare Ribs*, the outside wing can wash in further before the pitch devices cut in, and when they do, the wing profile maintains a clean aerodynamic shape without incurring the previous adverse yaw and roll out. Furthermore, since the new profiles do not require a high level of sail tension to minimize washout, billow shift can occur more freely and thus higher roll rates can be achieved.

Luff lines can also interfere during slow turns, where the inside wing is flying much slower than the outside wing. The lower airspeed on the inside wing unloads it and lowers the trailing edge, making it more likely the luff lines will cut in. If a gust unloads the inside wing further, the luff lines cut in, resulting in increased drag, reduced lift, increased stall susceptibility and the nose pitching up - just when you least want it. This makes the glider more prone to tip stalls and lowers its spin resistance. On the Concept, however, when the inside wing unloads the *Spare Ribs* cut in and prevent the washout reducing any further, without distorting the profile shape. These combined effects mean the Concept is less susceptible to tip stalls and has a greater spin resistance.

The increased roll authority and spin resistance, coupled with the lower stall speed allows the Concept to be thermalled markedly slower than its predecessor. When flying about a given thermal diameter, at a lower speed, the centrifugal force required to pull the glider into the turn is smaller and means a lower bank angle can be used. Resulting in improved sink rate in a 360 and climb rate in a thermal. Furthermore, the smallest diameter within which the glider can turn is improved, enabling it to core stronger lift and smaller thermals. These two aspects to turning performance are shown in Figure 4 (on next page).

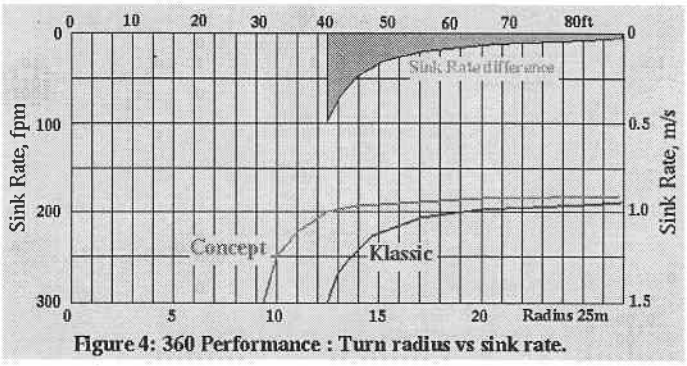


Figure 4: 360 Performance : Turn radius vs sink rate.

## Conclusion

The development of the Concept has been very much a product of Airwave's design philosophy of considering the glider's various flight characteristics together. The development of *Spare Ribs* and new profiles clearly shows a determination to solve challenging problems without following the herd in the rush to develop topless gliders. Along with distinctive solutions have come improvements to handling, climb and glide performance, while still meeting the international airworthiness standards.

Robert Osborn

Midland Valley Exploration Ltd.
14 Park Circus
Glasgow G3 6AX
Scotland.
Phone: +44 (0)141 332 2681
Fax: +44 (0)141 332 6792
email: robert@mve.com

## MORE ON THE CHOUCAS

*(ed. - Last month in my column I mentioned I would be publishing the English translation from the French magazine VOL MOTEUR, No. 130, Feb '97, pp. 37-41, provided by David Fitchette, one of our French members who is always contributing something of interest. This is the first installment of that article. I hope you enjoy it.)*

Orginal text by: Philippe TISSERANT

"Hello! Hello Philippe, when are you coming to try our Choucas? Winter approaches and all your colleagues have already come." This telephone call from Claude Noin replaced my end of September with a vacation of soaring. My reason for going was not so much to get a scoop, but one of benefiting from some of the last thermals of 1996 at Gap where this new ultralight was born and manufactured.

### OBJECTIVES

It's been more than 5 years since Claude Noin undertook the creation of Choucas. He imposed the following constraints. The glider had to be a biplace with performance being at least equal to those of Sirius (a monoplace) that he had already constructed. It had to be able to exploit this performance being self launching without outside assistance. Lastly, and maybe the most difficult requirement to meet, the glider must meet the French definition of an ULM of the era (this has since been changed), that is 175 kg maximum empty weight, and 10 kg/m² wing loading at maximum empty weight (not counting accessories).

"The flying wing came out naturally from these requirements" he explained. The short fuselage, and the absence of a tail would hopefully allow some meaningful weight reduction. The Fauvel type design was imposed on the ground of cg (centrage). It alone permits, thanks to the slight forward sweep, having the mobile masses (crew and fuel), within the center of gravity limits. You no longer need to worry about being with the cg limits. In addition, this type of wing is very well know in France since the creator, Charles Fauvel, certified several of its types, and you can still see one from time to time in clubs. My father, who is a long time glider enthusiast, finished convincing me by recalling the excellent performance achieved with this type of machine.

### CONSTRUCTION

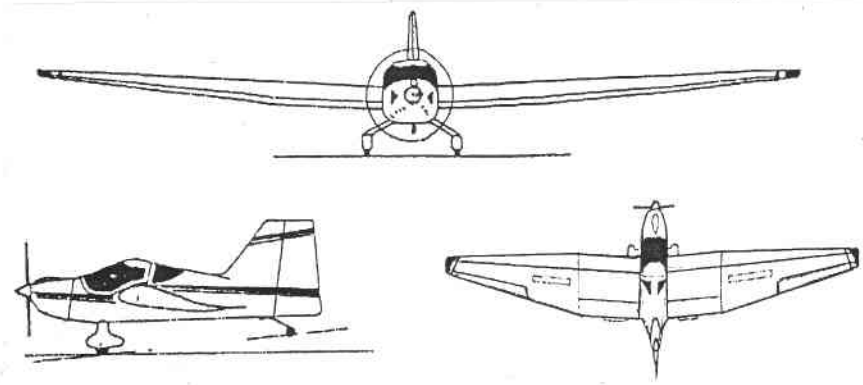
The main part of the plane, the wing, is constructed in two parts. In order to avoid any surprises, Claude Noin used the original Fauvel profile created by Georges Abrial before the war. With a chord of nearly 2.5 m at the root, a relative thickness of 18%, and a span of nearly 7 m, each wing panel represents a rather colossal piece that fills a large trailer created specifically for the Choucas. For the spar caps, Claude chose the material which seems to be the norm in all the recent construction, carbon fiber pultrusions. The leading edge is in 45° birch plywood. The leading edge plywood is glued to the ribs, made from expanded polystyrene, and to the spar in a form. Foam and fiberglass construction is also used for the construction of the maid ribs and for those of the rudder. Each panel contains an aileron, an airbrake (aerofrein) and an elevator. Because of the wing sweep, the technique of assembly generally used on the gliders which consists of inserting the spar through the fuselage and into the other wing could not be employed. Claude had to use classic fittings, Each wing, which weighs about 5.5 kg. is bolted to a frame integrated in the fuselage.

The fuselage, which should be small because of the lack of a tail, is fairly large because of the enormous vertical tail. The prototype fuselage is constructed in a fiberglass epoxy composite. In order to save weight, Claude has built one example entirely in carbon fiber but

he is not certain that this will be used in future examples. The motor is a simple Rotax 503. The cooling fan was preserved in order to not have overheating problems on the ground or while climbing. The cooling air is judiciously taken from the top of the cowling. Upon cutting the motor, the cooling is almost completely cut off reducing thermal shock cooling, and permitting restarting without using the choke ever after 15 minutes of gliding.

## WELCOME ABOARD

With nearly 15 m of span, the Choucas is as big as a classic glider but its short length 9.66, and its "wide" fuselage makes it to appear much larger. In fact, from a distance, it doesn't look like a normal plane, but as one approaches the cockpit you rediscover a very classic airplane. The canopy swings toward the rear thanks to 3



arms. It opens up the access extensively aided even more by the step integrated in the landing gear. Once aboard there is a considerable amount of space. A center console separates the two fixed seats and contains the controls for the motor as well and the airbrakes. Each occupant has a stick, a disposition which I know, is preferred by most of you. The rudder pedals are not adjustable. One finds the main instrument panel very complete which will be enjoyed by those who like lots of instruments. The visibility is perfect, even forward while on the ground, in spite of being a taildragger. Those who exercise soaring a great deal will regret the cap (canopy top) which connects the windshield and rear windows. (ed. - this comes over the pilots heads and restricts visibility above and to the upper sides.) Those bent more toward cruising will appreciate this sun shade. The rear windows improve the visibility in this sector. A large rear bench give a place to put maps, headphones or glasses. It is preferable to use this bench for light weight objects because of the cg. Larger baggage will easily find its place in the interior of the leading edges (wings) which are accessible from the fuselage.

## FLIGHT

I can tell you immediately that in two days I had with Choucas I really enjoyed myself. The four hours of flight, with more than half without the motor, put me back in the sport of soaring in spite of the weather being not all that favorable. I tried out this motor glider with Charly Baum, who is working with Claude to manufacture and commercialize Choucas. Charly is a real flight enthusiast. An expert parachutist, he built on the airfield of Gap, Gap-Tallard, a transport company and repair shop also specialized in the dropping of the parachutists. Starting the motor requires no special expertise. Electric fuel pump ON in order to aid the Mikuni pump of origin which pulls the fuel from the reservoir (which is structural) placed underneath the seats. ONE cm of throttle, choke ON, and a stroke of starter. The motor, which has 150 hours starts instantly and we let it warm up reducing the choke by small touches until the motor purrs.

On Choucas, I am instructed not to use full throttle until the cylinders have reached 180°C. Apparently, this recipe seems to work as the motor is as strong now as when it was new.

We take our turn to take off after a Robin and a Twin Hotter while an ASK 13 is towed onto the grass runway. The good atmosphere which reigns on this airport is worth mentioning.

Full gas, I push a little on the stick in order to put the Choucas on its main gear after which I only have to wait for takeoff which occurs in 10 seconds with a Vi of 55 km/h (Indicated Velocity). It is important not to solicit the takeoff for, on a flying wing of this type, a pull on the stick is equivalent to a stroke on the brake and the Choucas will land. (ed. - remember Jack Lambie's comment last month on inducing a sink when pulling back on the stick to clear a farmer's spinkler line.) We let the speed increase to 85 km/h before we begin the climb. The vario indicates 2 m/s which is out of the ordinary for me considering the amount of power from the motor and the large mass of the prototype. While we climb, Charly calls his friend Jacques Joel who is giving some training in the ASK 13 to Pierre Bouilloux, a guru of paragliding. They are flying at the foot of the Cëuze, in a small 0.5 m/s lift. Alas, when we approach, the lift disappears and Noel recommends the Blailleul to the south east.

We display 135 km/h at 5,400 rpm, the economical cruise, and in 10 min. we arrive. Effectively, this yields lift close to the slope. It is necessary to say that it is late and that the prevailing wind from the north counteracts the up slope lift. After a half-hour of figure-eights just above the rocky slope with the motor off, I discover the fineness of Choucas. The ailerons are firm but sufficiently effective in these conditions. The rudder maintains flight symmetry without large pedal input. For the elevator, it is best to use it as little as possible, just enough to maintain the optimum speed of 85 km/h. Since one can become bored or anything, Charly proposes we go look at the local scenery five kilometers from the extremity of the mountain. No problem, the Choucas, motor cut, takes us there with a comfortable margin of security. On restarting

the motor, we let the head temp warm up a little passing above Digne at 1,000 m. Next, we return towards the Rock of Hungary above the terrain of Vauhmeil. We climb again to 2,600 m with the motor. In the distance I see the peak of Monsérieux which blocks from view the terrain of Tallard. The air is still, it is nearly 6 o'clock, and Charly wants to demonstrate the glide ratio of Choucas. We cut the motor again. Without believing it possible, I aim toward Tallard keeping the airspeed at max. glide ratio speed of 90 km/h. In spite of the slight headwind, little by little I see us pass the ridge in our descent plan. In arriving base south, we are still 500 m above the terrain. The glide ratio announced at 22 is not far! After a short solo flight in the late evening, I rediscover Choucas the following morning for a more in depth test.

*(ed. - We will save the solo flight testing part of the article until next month, along with a short conclusion on the Choucas' overall performance. We hope you have enjoyed a little bit of what flying in Europe is like with this tale and are getting a favor of this aircraft's capabilities. Like the PUL-10, there may be possibilities of Choucas eventually finding its way into the American market, which would be excellent since there are no American equivalents at this time (two place, that is, in case you were thinking of Genesis ).*

## A BIT OF HORTEN HISTORY

(ed. - The following is just a small faction of the type of information flowing from the Nurflugel mailing list being run by Douglas Bullard. It is from Russell Lee, Curator, Aeronautics Department, National Air & Space Museum, and was in response to questions being asked about the Horten IV currently on display at the Planes Of Fame Museum at the Chino, CA airport.)

Subject: Re: Nurflugel Ho IV N79289

As best as I can piece it together, this is a capsule history of Horten Ho Iva, N79289 - Werk Nr. 25, completed 20 April 1943 at Gottingen. Registered D-10-251, later La-AC, British Gliding Association number BGA 647, US civil registration N79289. Discovered (by Allies?) at Gottingen in 1945 with trailer. Horten brothers (?) loaned it to Robert Kronfeld in England, to Farnborough by RAF Halifax and flown on 11 October 1945 (by Kronfeld?).

On static display at Farnborough Oct. 29 to Nov. 9. Extensive fight test program, often airtowed by Fiesler Storch Fi 156 AM 101/VP546. Allocated captured aircraft serial #VP543 on 26 April 1946 and flown at Farnborough until 1947.

Bought (as private aircraft) by R. Kronfeld 8 Dec 1947, transferred to Lasham 17 February 1948. Stored at Hawkridge Aircraft Co. Ltd, Denham, Autumn 1948 through May 1950. Flown twice by Robert "Jock" C. Forbes, May 7, 1950, at the College of Aeronautics, Cranfield. Sq. Ldr. F. Crocombe bought the aircraft in 1950 and obtained civilian Certificate of Airworthiness BGA 647, then to Glider Press Ltd., then bought by AAF Off. Hollis E. Button. Flown by Eric Brown who described the experience in "Wings of the Luftwaffe."

Button shipped the aircraft to Valley City, North Dakota. Crashed first flight takeoff, Button leased to Rudy Opitz. US Airworthiness Certificate 15 May 1952. Opitz flew it in Midwest Gliding Championships, July 1952, Toledo, OH, winning the contest. Opitz next competed in August 1952 National Soaring Championships, Grand Prairie, TX. He finished 7th.

To Mississippi State Univ. in Sept. 1952, by now 180 flying hours on the aircraft. Flown and tested there extensively by Ray Parker, Dezso Gyorgyflavy, Opitz and others in program run by August Raspet. Air. Cert. expired May 1953. Glider rebuilt by MSU and Cert. renewed 26 Oct 1959 with 25 mile flight restriction. More tests financed by US Army Transportation Command and US Navy Office of Naval Research. Sold Oct 1964 to John Caler of North Hollywood, CA, now with 708.5 flight hours on airframe.

To Professor John L. Groom of Redlands, CA, then to Ed Maloney who completed restoration about 1994.

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