

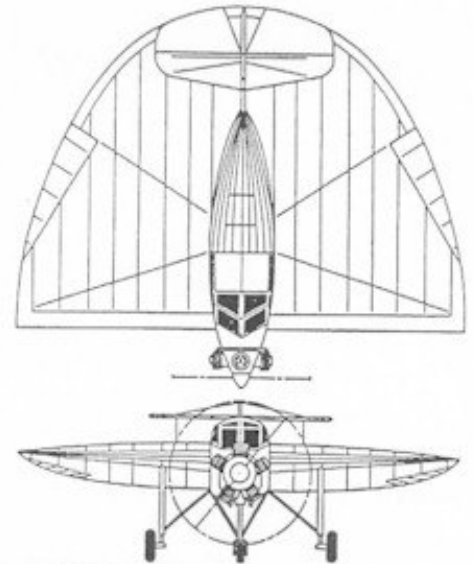
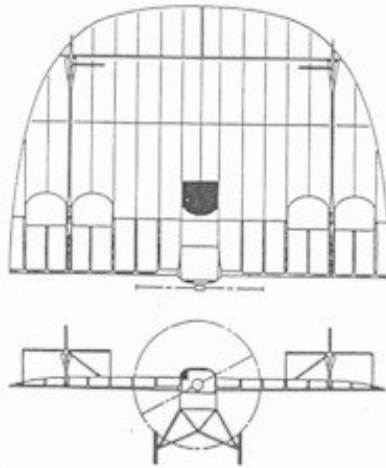
T.W.I.T.T. NEWSLETTER

RIGHT: The top and frontal view of the Snyder-ARUP S1 designed by Dr. Cloyd Snyder.

FAR RIGHT: The top and frontal view of the Snyder-ARUP S4.

Notice the progression in shapes from both angles as the design was refined.

Source: Skyways, July 1995.
Material contributed by: Serge Krauss.



CELEBRATING OUR 11th YEAR

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., 9707 means this is your last issue unless renewed.

Next TWITT meeting: Saturday, July 19, 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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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

Well, so far no one has taken me up on the offer of a one month extension on their subscription by coming up with what was different on the first page of the June newsletter. So the offer still stands if anyone is interested.

As you will see (or have seen if you read the good stuff before coming back to see what I have to say) this issue is full of PUL-10 stuff that I have managed to extract from Douglas Bullard's homepage. He has done an excellent job of pulling the information together from the factory, including scanning in some of the pictures that you see in the article. He also has a lot of material on other flying wing designs like Lippisch and Northrop and is always looking for new pictures to include on the page.

The number of people on his mailing list continues to grow, showing there is a lot of interest worldwide in flying wing aircraft. It is my opinion that we (TWITT) have been on the leading edge of this area for years (11 this month to be exact) but have been unfortunate enough to not have the financial means to take it to its ultimate conclusion, a flying example of a high performance tailless sailplane.

I know that TWITT will never be able to come up with the ultimate design, but it is gratifying to know that we are again growing. Perhaps one of these new members will be the catalyst in coming up with a design that is easy to build from plans without the builder being a master of all things aeronautical and engineering.

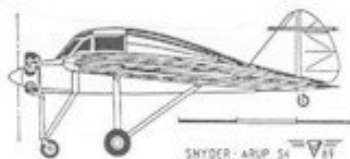
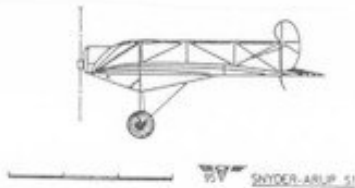
In case you missed the announcement in last month's newsletter, don't forget the Flying Wing Symposium will be held on July 17 at the National Soaring Museum at Harris Hill, NY (on the hill above Elmira). It is the first day of the SHA Eastern Workshop and has been generating a lot of interest all over the world. It is being touted as the premier gathering of flying wing experts alive today and should prove to be an event you shouldn't miss if you have any chance of getting there. For me it comes at a bad time for work and the cost it just a little steep for the CA to NY journey, but I know we have a lot of members on the east coast that must have a few days of vacation coming. So take some time and go see what the big boys have to say about the future of flying wings within the sport aviation community.



**JULY 19, 1997
PROGRAM**

Last year Serge Krauss sent us a letter with a name and address for Richard Snyder, the son of Dr. Cloyd Snyder who designed the series of aircraft called ARUP in the early 1930's. He was living here in San Diego, but the letter didn't have a phone number and there were numerous R. Snyder's in the phone book. Well, the other day Gavin Slater, TWITT Archivist, came across the letter and he and June decided to do some more follow-up. Low and behold, they got the right person on the first try.

So, part of the July program will feature **Richard Snyder** who has some very interesting pictures of his father's work and the stories behind the development of the ARUP aircraft. He will have this material on display around the hanger and will be answering questions from the group. To remind you of these aircraft, we have printed the side views of the first four versions below.



The other part of the program will be **Marc dePiolenc**, one of the early founders of TWITT, who has a 45 minute presentation on ducted fans for small aircraft. Since the mid-80's, when he worked on the design of a shrouded propeller for a small blimp, Marc has taken an active interest in low speed ducted fans.

A thorough survey of existing ducted fan projects showed the same basic errors being repeated over and over again, even by professional aeronautical engineers, in some cases. An equally thorough search of the literature revealed that there was no useful design guidance available to non-engineers on this topic.

Marc and his partner George Wright decided to take up the challenge of first devising a simplified design method for ducted fans, then embodying it in a textbook. According to their criteria, the method had to require no math beyond high school algebra, no knowledge of physics or aeronautics beyond that required to pass the written exam for the Private "ticket."

The book came out late last year, and Marc more recently put together an outline of the method, which he will present to TWITT.

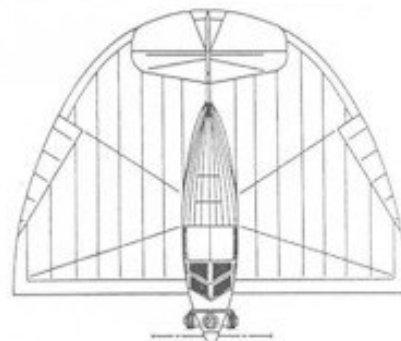
The talk is in three parts:

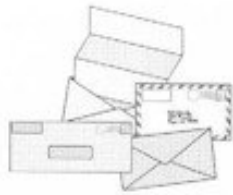
1. Introduction: history, definitions, common design errors
2. Design
3. Survey of existing ducted fans and ducted fan aircraft.

Since this will be the first time the talk is given, Marc would appreciate criticism and suggestions for improvement.

DON'T FORGET, THIS IS OUR 11th ANNIVERSARY PARTY SO THERE WILL BE ICE CREAM AND CAKE FOR EVERYONE TO ENJOY IN CELEBRATING OUR CONTINUED SUCCESS.

BELOW : Top view of the S4.





LETTERS TO THE EDITOR

6/15/97

TWITT:

I miss coming to the meetings, but always enjoy the newsletters. Andy, you do a wonderful job of interpreting & summarizing the technical presentations.

I am fully involved in designing, building, flying, rebuilding, etc., RC powered models. Only good slope soaring is 150 miles away at Los Banos Reservoir so I haven't flown my Manx forward swept wing sailplane much this past year. A couple of plank-type tailless power planes in our RC club fly very well, stable and aerobatic.

The PUL-10 looks like it could be an interesting subject for a model.

Enclosed is my subscription renewal check.

Best regards,

Paul Stahlhuth

(ed. - Thanks for the letter. We were kind of wondering how you were getting along in your new homeland. Sorry to hear that you have had to concentrate on powered modeling with all the gooey oil and batteries and such to mess around with and clean up after. I can sympathize with the long drive to a slope, since that was what I had to do when I first got started in RC and didn't want to fly from a hi-start.

I believe we will be seeing a lot more on the PUL-10 over the coming months. As you will see in the next letter, Barney is trying to import one and is looking to perhaps becoming a US distributor if everything goes all right. Eventually, it may be possible to get some preliminary specs from the factory that would allow a more precise scaling for a model version. They may even have some model design drawings, considering how they have gone about putting this whole project together.

Keep in touch and send us a picture or two of those wings in your club.)

6/23/97

TWITT:

I have returned from a low cost airline price war round trip to Germany where I stayed with the people who are building the PUL-10. We intend

to all work together to write the construction manual for the kit when it is released to the public.

Their prototype is flying, being tested and perfected, and there are no shortcuts as they make small changes to the mechanics of this plane. Some examples of "bugs" they removed while I was there were the replacement of gear door rods with steel rather than aluminum which could bend at higher airspeeds, plans to ballast the CG almost automatically with a shifting weight of probably no more than 20 pounds, and possibly trying a BMW liquid cooled engine that will be more efficient and cost less than the Rotax 912; and the exhaust pipes will last longer too.

The PUL-10 airframe is much easier to work on than any factory built airplane I have ever seen, and it is mechanically more elegant and simple. The only difficult thing was the Rotax engine - at least the alternator, which is hard to reach on the rear mounted engine. But the customers will be able to choose which engine to use.

We do not know what the kit will cost yet, but obviously the absence of a fuselage and tail will make it easy to produce and sell for less than something with a tail section. It will also be possible to build it in very little time because all the fiberglass parts will be made completely in molds, so you will not need calamine lotion from epoxy vapor rashes that come from the more tedious projects.

We are concerned with a couple of things in selling kits. First, we would not want to sell a kit to someone who might be irresponsible and ruin our reputation by flying drunk and crashing for example. Also, Nurflugel takes a dim view of the tobacco industry and does not want the beauty of their plane used for cigarette ads as a canard was used to advertise Salem.

The PUL-10 could be made IFR capable, but it will take some imagination to fit together the instruments in the limited space available between the orthopedic, chiropractic designed seats, which are incredibly comfortable, and the upper surface of the wing. In particular, the attitude indicator will have to be mounted side by side with the HSI between the altimeter and the airspeed indicator as is done in the more modern CRT panels in airliners. For those kit builders, who want an IFR flying wing, I will make suggestions.

Please print the address of the website which has information on the PUL-10 and feel free to write to me if anyone wants to get on the list for a kit. But

understand, it is difficult to estimate when the kits will be available. I can't wait any better than you can.

Respectfully yours,

Barney Vincelette
 P.O. Box 141
 Houston, DE 19954
 (302) 422-3980

(ed. - Thanks for the letter updating us on your efforts to help get PUL-10 kits introduced to the US. The website address is included in the article below and is the source of the pictures I have been using last month and in this issue. I have also had some of your pictures half-toned for inclusion this month since they show some parts of the airplane not seen on the web.

I included your address and phone number so people can get a hold of you easier and talked about where the project is going. Perhaps you will find some who are willing to help. I know you have been in touch with Douglas Bullard who runs the website and he seems very enthusiastic about the prospects for the airplane.

I will put your letter out to the mailing list since it has some new information that has not appeared there in the past. This may produce some more letters and calls since the list has a very wide following of people who are extremely interested in finding a flying wing to build.

Good luck, and keep us informed of any further progress.)

THE PUL 10

(This is a continuation of the article started in the June 1997 TWITT Newsletter. It was extracted from the Nurflugel website maintained by Douglas Bullard, who obtained the information from the factory representatives. The website address is:
<http://www.nurflugel.com/~dbullard/nurflugel>)

What might the future hold?

In Europe:

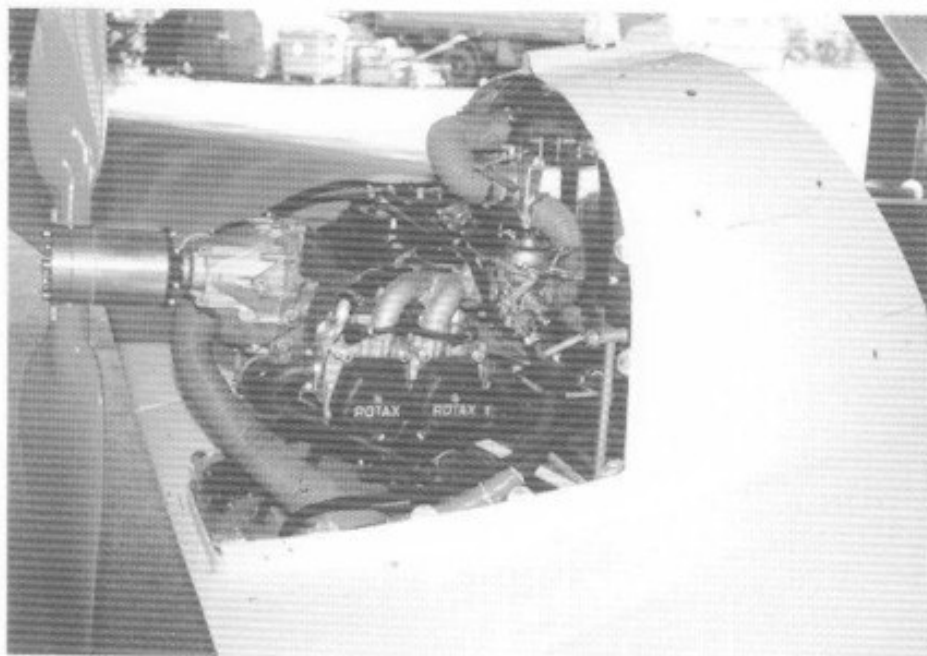
PUL-10 as an Ultra-Light plane (about 25% of all requests). The European Ultra-Light standards have been adjusted to a maximum takeoff weight of 450 kg (992 pounds). Ultralight flying is becoming more and more popular because the performance of Ultra-Light planes has been improving over the past few years and they are still much cheaper than other planes. If we can reduce the weight of the PUL-10 and still keep the 80 hp engine, it will be the fastest Ultra-Light on the market.

PUL-10 as Ultra-Light kit (about 15% of all requests)

PUL-10 as an mass produced airplane (about 20% of all requests). At the time of this writing the PUL-10 is registered as an experimental airplane. The costs and demands for a mass produced airplane are very high.

RIGHT: Here is one of Barney's pictures showing the right side of the Rotax engine installation. Note the gear reduction unit and, 2-bladed propeller which is different than earlier pictures with a 3-blader.

PUL-10 as an kitplane (about 40% of all requests). There is no German competitor on the market. Most kits come from America and so do most requests for information about the PUL-10 as a kitplane. This is a very big market. In America, registration and inspection of a kit is very easy, where any kit that has been flown for 40 hours without incident can, if it has the



required equipment, be flown even in instrument flying (IFR) conditions. Magazines such as Kitplanes can be found in most American book stores. Airplane kits are becoming popular in Europe too.

PUL-10 as an ULTRA-Light glider. The German Association of Ultra-Light Gliding has offered us help in such a registration because the association is looking for a glider appropriate for teaching. The investment for producing this version of the PUL-10 is small (the wing span would have to be increased to about 16 meters). There are no competitors for the market, and ultra-light gliding is becoming very popular in Europe.

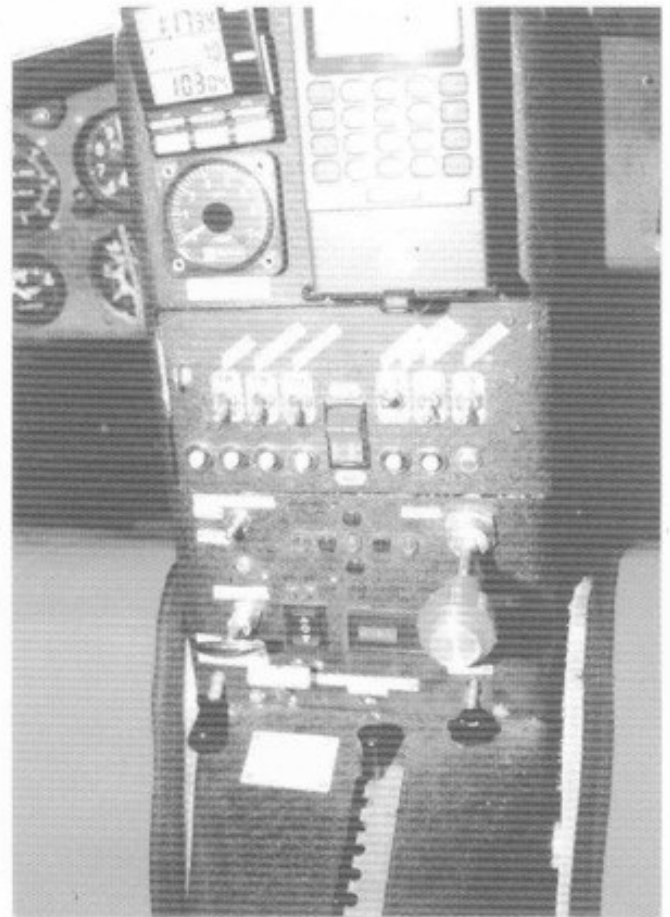


ABOVE: Here is a picture of the aircraft on its trailer. Note the airfoil shape and thickness. Trailering was probably done due to the high cost of hanger space in Europe so the pilot could take it home like a glider and put in a lower-cost garage or park it next to a home like Americans would an RV. Source: D. Bullard's Nurlflugel web site.

PUL-10 as a motor-glider. This would be an ultra-light glider with a motor.

PUL-10 as a glider. In this form it would have a wing span of 18 meters. Even in the 1940s Dr. Horten achieved astonishing performance with flying wing gliders. The Horten IV had a glide ratio of 31 and the Horten VI a glide ratio of 45. With newer materials, results will be even better. During an EAA seminar in the 1993 Oshkosh fly in, one of the Rutan brothers said: "If I were entering a gliding contest and found that somebody I had to compete against was using a flying wing I'd throw in the towel"

The variations up to here are based on the present shape of the PUL-10. For the following versions



ABOVE: Current picture of the center console of the PUL-10 cockpit. Picture by Barney Vincelette.

new molds for the wings would have to be built. The center section could be used without modification. Prof Dr. Horten designed the PUL-10 center-section for universal use in different types of planes.

We could produce such different models using a small number of molds. Dr. Horten designed the PUL-10 with such a possibility in mind.

Other possible projects for the future.

With the right investment and demand, the sky is the limit. In 1992 Dr. Horten designed a four seat flying wing with a 12 meter wing span. Normal registration of such an aircraft for mass production would be too expensive for less than the largest companies. However, for the American market, a four seat kit is possible. Dr. Horten left us with the

knowledge to build even bigger flying wings. He planned passenger planes that would fly 30 meters over the water in ground effect using less fuel and costing less to build than today's airliners with their pressurized cabins and air pollution.

(ed. - The following is some historical information on Dr. Reimar Horten included in the PUL-10 promotional material. I thought it might be of interest to many of you.)



ABOVE: PUL-10 sitting in front of the hanger awaiting a test flight. Note the nose gear door and fender over the wheel to keep from throwing dirt and rocks onto the bottom of the wing. Picture by Barney Vincelette.

In 1933, Reimar Horten built his first flying wing, a man carrying glider in his parent's house. Encouraged by success, he built the Horten 11, the world's first motor glider. By now his flying wings were attracting so much attention that he was helped to continue his work. He built many prototypes, most with plans for mass production.

By 1944, the Peschke company placed an order for more than 20 Horten VII flying wings, and the Klemm company placed an order for 50 Horten IIIe. Such well known companies as Junkers, Heinkel, Messerschmidt, BMW and Focke-Wulf were submitting flying wing designs to the Ministry of Aviation as the war was ending and Germany had achieved a leading position in aeronautics. This is probably

why airplane construction was prohibited in Germany after the war.

Flying wing development in Germany ended. Many flying wings were destroyed, some were taken to the United States. (At the time of this writing, four flying wings which came from the United States are being restored in Berlin.) The United States was very interested in what German engineers had learned from flying wings. We suspect that this led to the decision to build the B 47 with swept back wings rather than the straight wing of its earliest designs.

In 1948 Dr. Horten emigrated to Argentina where he could continue his work on flying wings. There he supervised the construction of a couple of flying wings, including the four engine Ae 38 transport which could carry 10 tons more than 1100 nautical miles.

Unfortunately, the general who supported flying wing development was replaced by someone who ordered the transport grounded. At the university he was only allowed to teach the construction of conventional aircraft and his communication with aircraft

builders in other countries was disrupted by the state opening his mail.

In 1950 German researchers attempted to build flying wings, but without the experience and wisdom of Dr. Horten. They were so unsuccessful that many believed that the flying wing could not be built. Throughout his life Dr. Horten was plagued with what he called the studied narrow mindedness of his colleagues. For example, in 1943 a famous aerodynamics scientist declared, "Sweptback wing designs run the risk of falling over one wing with loss of control over the plane", even when Horten's airplanes had no such problem.

More information is contained in the book: "Nurflugel, die Geschichte der Horten-Nurflugel 1933-1960" by Reimar Horten and Peter F. Sellinger, Weishaupt-Verlag Graz ISBN 3-900310-09-2.

**NURFLUGEL PUL-10
DISCUSSIONS**

(ed. - Here is a sample of the type of discussion that goes on within the Nurflugel mailing list, in this case having to do with the PUL-10 since we (I) seem to be on that kick for right now.)

5/28/97

I'm very excited. I received a big pack of pictures and information on the PUL-10 from Bernhard Mattlener, of Nurflugel flugzeugbau. The pics are just gorgeous, I'm scanning them in ASAP. One of the pics was of Reimar Horten!

Bernhard announced that on May 15, the PUL-10 made it's first flight with an official German experimental registration.

We gotta get these guys over to Harris Hill, I think they'd fit right in!

I'll send out another note when I've got the pics scanned. I also have about six articles in German which talk about the PUL-10, I'll see what kind of job my translator can work on them (shudder!)

5/30/97

Hi, Andy. I just posted a bunch of stuff from Nurflugel Flugzeugbau (great name!) onto my website.

Thought you'd like to see the pics, they sent quite a few. What a great plane!

Look for the PUL-10 stuff in the Horten section (where else?).

Also got a new photo of Reimar Horten circa 1993, in the Horten biography section.

Douglas Bullard

6/1/97

After checking the specs on the PUL-10 and drawing a planview of the wing, I found, from my calculations, that the cg locations, fwd and aft, are at 26.8 and 32.7%MAC respectively. This seems to me to be too much aft. Can anyone confirm this.

Hakan Langebro

6/4/97

Haakan Langebro (asked): What exactly is the C-point abscissa? Have I missed something in my research? Please give me some details!!

Bob Bigelow (wrote):

In the Nickel/Wohlfahrt book "Tailless Aircraft..." I have been trying to calculate the C-point abscissa for the Horten sailplanes as shown on page 79. To calculate the C-point I am using the equation at the bottom of page 79, 2.7.5, and my results are in error by a factor of at least two. Is there a better equation? Any help would be appreciated.

Renaud Mangallon (asked):

Bob, I don't have this "tailless..." book so I cannot see what you mean, but I'm very interest in the Xc (and its possible modern evolutions). Where do you locate the Xc C-point ? We could compare our results.

Al Bowers (filled in the blanks):

First, Bob, the US version has different page numbering, and it might even be a different equation numbering (though I find this very disturbing, someone must be missing some data!). I think the US version of the book has the equation in question on page 74, and the equation is 2.6.2, so I don't know what's going on.

Back to the question posed by Haakan, there are some definitions that Nickel/Wohlfahrt use (from Horten). Here are the ones in question (some are obvious):

CG-point: the center of gravity (except in Europe where I believe it would be the "Centre or Gravity" or some such)...

N-point: the neutral point; where the pitching moment goes to zero with respect to angle of attack (note that there are TWO of these, one for stick fixed and one for stick free).

E-point: center of lift for an elliptic distribution (Nickel/Wohlfahrt make a big statement here about elliptic being optimal, but this is rarely achievable in real life).

C-point: center of lift for constant local lift coefficient (imagine the entire wing lifting at the same Cl).

6/4/97

Thanks Al!

F.Y.I. I made a stability and control analysis (a quick one) of the PUL-10, and from the data that I have available I can give you some info:

MAC: 70 inches

25% chord, sweep (average) 30 degrees

Stick fixed neutral point:

1. Cg max fwd (14.13%MAC), 38kts, 1215lbs, full throttle: 49.7%MAC
2. Cg max aft (18.5%MAC), 38kts, 1012lbs, idle: 18.7%MAC

Gives a static margin of 35.6% MAC at #1
 Gives a static margin of 0.2% MAC at #2
 Elevon deflection @ 1: -18.7 degrees
 Elevon deflection @ 2: +0.3 degrees In

ground effect.

Cl max @ gross weight (1215lbs) 1.48, high, compared to previous Hortens which are around 1.1-1.3 with non flaps!

As you can see there are not much room for different cg locations. Max cg movement is 5%!!

Håkan Langebro

6/5/97

Hi. The center of pressure (CoP) for the full Horten bell shaped lift distribution on the PUL 10 trapeze-wing (without center section enlargement) is at 1.644 m from the nose. Horten used as design CoG 1.625 m, not including the lift loss in the center due to the central body. The real achieved CoG can be somewhat aft, as the real lift distribution shifts the CoP rearward.

Reinhold Stadler

6/5/97

Thanks Reinhold

Is there anyway that you can provide the aerodynamic calculations and documentation for the PUL-10? I do understand that this is proprietary information but I would be seriously interested. Please let me know.

Håkan Langebro

6/6/97

Hello. I have talked to Bernhard Mattlener, his greetings to all! I have told him that there is some discussion ongoing about the PUL 10.

To Doug, I have warned him about your coming letter and he says thanks to you in advance (ed. - this was D. Bullard requesting information for posting on the Nurflugel web site and was the source of the pictures seen in this newsletter). Mr. Mattlener would have liked to come to the Flying Wing Symposium (at Harris Hill, NY), but that is a financial and time problem. These guys have put all their money to make that nurflugel real... And there is a lot of work to do at the moment so there is nearly no spare time. So maybe the next time, he will try.

There was some discussion about the CoG. I have asked Mr. Mattlener. He is open to share our knowledge to discuss all the topics. It should be clear that he is still in the prototype status and we want to make the PUL 10 a good example for a flying wing. So every discussion, help and hint is welcomed. I think this is a good forum to give another kick to the nurflugel-idea...

So, Hakan, let me know, we are open...

And last but not least here are the first questions from our side: the CoG-range on the flying wing is fairly small (PUL 10 ca. 5 cm). Is there any idea how to adapt the CoG in an easy and possibly automatic way (the difference between one and two passengers makes a lot on the PUL 10). The CoG-positions in Dougs Homepage are preliminary ones, and have to be finalized. The forward CoG gives a quite noseheavy plane.... is there any possibility to do some CFD (panelmethods etc.) and flight mechanics calculations. That's especially interesting for me to check my simple calculations!

That's for the moment,

Reinhold Stadler

(ed. - To give you an idea of what these people do, I have included parts of the bios they provided to the mailing list group. The caliber of individuals on this list is fantastic, but I know that we have some of the same levels of talent within the TWITT membership as evidence by some of the material we have received over the years.)

Hakan Langebro

Started to work for a company called Scandinavian Aircraft Construction in the late 80's, then shifted to small R&D outfit called MFI (Malmö Flygindustri) where I worked with Björn Andreasson, if the name is familiar. In 1992 I was promoted to chief designer and among other things I designed the aircraft MFI-11 in 1991-92 (See Jane's 1994-95 for info). Company went bankrupt in 1994 and shortly thereafter I moved to Canada.

Spent 6 months in Texas working for Bell Helicopter's main office. Currently working with the prototype development of the new Bell 427 all composite helicopter, a really interesting job!! First flight scheduled in Nov. this year, keep your eyes open!! I'm also a private pilot and I owned the MFI-11 until I sold it in 1995.

Rheinhold Stadler

I am systems engineer at MAN Technology here in Munich working on reusable space launchers. My last project was a study for ESA where I was responsible for two of the launcher concepts (TSTO and SSTO, looks more than it is). The job is very interesting, but typical for the European aerospace industry there is not much room for personal development...

Main hobby is Horten flying wings and drawings (I did some cutaways of Horten airplanes), photography, and at spare time a little sport (biking, skiing).

During the last years I have spent most of my spare time to do some calculations for the PUL 10 guys (aerodynamics, structures...). Horten enthusiasm started with my final "Diplomarbeit" about the Ho 229 at university, where I got in contact with both Horten brothers, and it's still fascinating....

Since three months there is another hobby, the nurflugel mailing list. It's the first time that I can discuss all the flying wing topics and there is a lot I can learn here!



ABOVE: Let's have a little change of pace. Here is a view of the Horten IV in flight from above. Notice the high aspect ratio. Source: D. Bullard's website.

AVAILABLE PLANS & REFERENCE MATERIAL

Coming Soon: Tailless Aircraft Bibliography
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