No. 299 MAY 2011

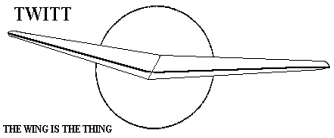
T.W.I.T.T. NEWSLETTER

Inflatable flying wing on display at the Aero 2010 at Friedrichshafen, Germany. Photo by Alex Kozloff.

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

The number after your name indicates the ending year and month of your current subscription, i.e., **0505** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, May 21, 2011, beginning at 1:30 pm at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - Southeast side of Gillespie).



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

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

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Internet: http://www.twitt.org
Members only section: ID – **20issues10**
Password – **twittmbr**

Subscription Rates: $20 per year (US)
$30 per year (Foreign)
$23 per year US electronic
$33 per year foreign electronic

Information Packages: $3.00 ($4 foreign)
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$1.00 ea + bulk postage

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48oz/48	40.00	42.00	30.00
60oz/60	50.00	53.00	37.00

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 (#1720), east side of Gillespie or Skid Row for those flying in).

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PRESIDENT'S CORNER

THERE IS NO FORMAL PROGRAM SCHEDULED FOR THE MAY MEETING

You are welcome to come by the hanger and visit, or wander around the area and see what aviation projects are underway at Gillespie.

I was pleased that this issue was filled with letters and other good information from especially the Nurflugel discussion group. I was going to add one more piece from Al Bowers, but it ended up being much more than I had space for, so I will plan on putting the whole thing in the next issue. It covers his presentation on minimum induced drag and has a link to the slides he used when making this presentation a couple of years ago. I am sure you will all enjoy it, since the Nurflugel guys are still trying to mull over all the facts and figures to come up with intelligent questions to fire back at Al.

Right now I am planning on giving you at least Part V of the A.R. Weyl paper on the Stalling Phenomena and the Tailless Aeroplane in the July issue. Parts VI and VII are also ready to go so depending on letters and other material that may come my way I will plan on using them through August and September.

If you live in the eastern parts of the US I don't imagine you are getting much flying in right now with all the rain and severe weather. To make you jealous it has been in 80's and clear here in southern California for the past week. It does make it hotter than normal when working in the hanger on my 1-26 re-build, but I was awfully tired of being cold all the time. I hope you can get back in the air soon.

Andy

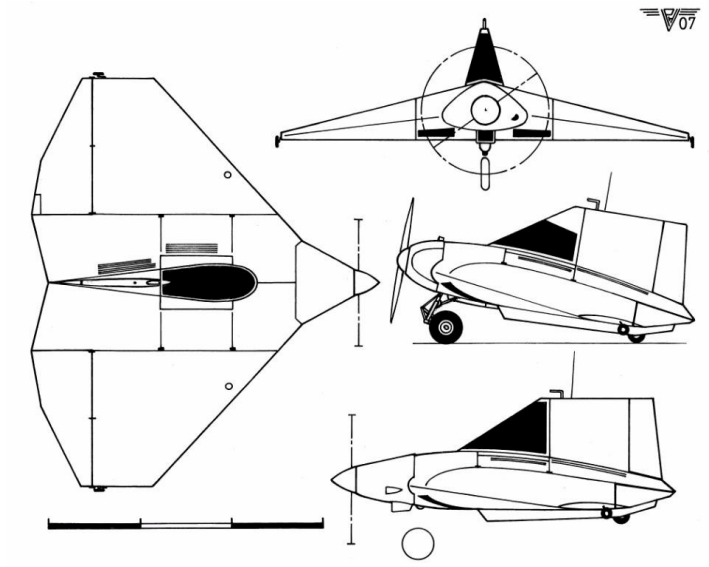
LETTERS TO THE EDITOR

April 10, 2011

(ed. – I wrote the following to Philippe Vigneron: "I had a call this afternoon from one of our TWITT members looking for more information on the Delta design drawings you had sent along and I included in the April issue that just came out. Do you have things like specifications, airfoil, etc. that might help him? I think he may be interested from a model standpoint, but he might also be looking at building something or at least researching it further.")

Dear Andy,

Please find here-attached some information on Bart Verhees "Delta":
- His e-mail address is: *info@verheesengineering.com*
- Two drawings he sent me concerning the general arrangement of the "Delta" and the front landing gear.
- A rush translation into English of what I have gathered concerning this aircraft.
- The general dimensions and characteristics.

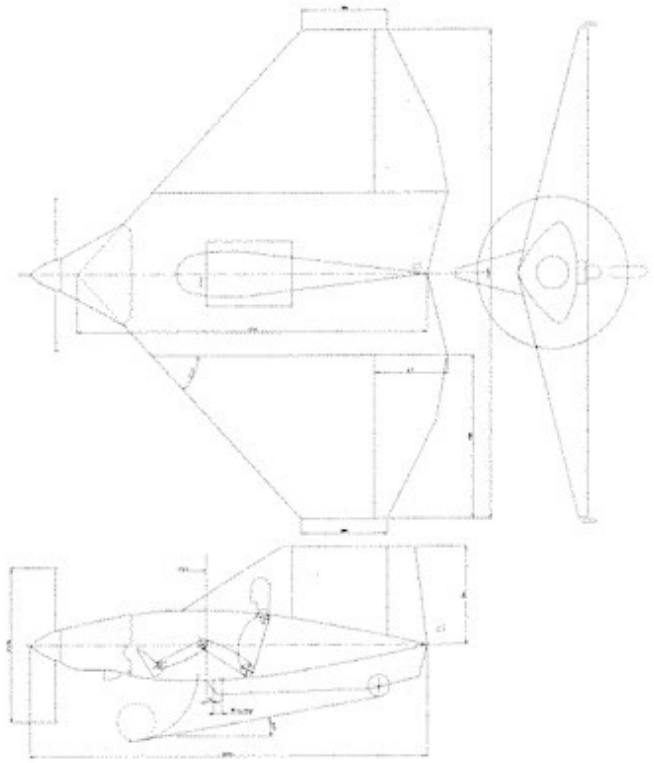


Hereunder some comments from Bart concerning the power plant:

"Propeller: 138x110 cm which is normal for 1600 cc direct drive engines like the VW. If I were you I would not take a Hirth, better use a Rotax when it has to be a 2 stroke, but better a 4 stroke, when you have enough money the Rotax 914 would be the best for performance, a cheaper solution is a VW or Subaru. The Subaru can have a gearbox and can produce more than 100 HP (1800cc), fuel injection and turbo is also possible."

Hope this information will be helpful for TWITT members.

(ed. – Since our member doesn't have an Internet connection I made copies and sent them by snail mail. Haven't heard back yet so don't know whether this was useful information for his project.)



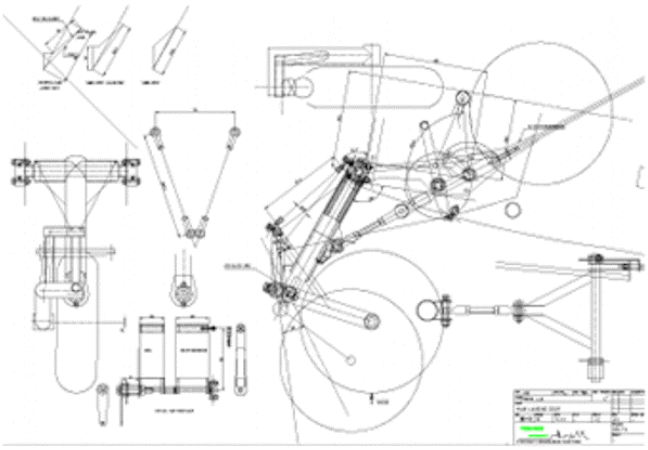
Bart VERHEES

After the design of man-powered ecological vehicles called velomobiles, Bart Verhees, in 1990, turned his attention to homebuilt aviation, founding the engineering agency "Verhees Engineering" located at Lommel, Belgium. He first tested a series of large scale-models responding to diverse aerodynamic configurations from conventional to more exotic ones like canard or circular wings and finally selected the tailless delta wing for his single-seat single-engine aircraft named "Verhees Delta". This configuration indeed allows a light structure while offering an important internal volume thanks to the wing-thickness and the cockpit canopy integration into the vertical fin.

The Dutch regulation requiring, for homebuilt aircraft, the control of the design specifications by an expert and since Verhees could not find one interested, he turned first to Great Britain to forward his Airworthiness request file, then, in absence of any answer, towards France where the aircraft received the provisional registration F-WDHV (to be transformed into definitive registration F-PDHV after the test flights).

			Dimensions				Weights		
Designer	**Model**	**Year**	**Span** ft (m)	**Area** Sqft (m^2)	**Length** ft (m)	**Height** ft (m)	**Empty** lb (kg)	**Loaded** bl (kg)	**Max.** lb (kg)
Verhees	"Delta"	2003	14,76 (4,5)	107.6 (10)	10,66 (3,25)	4,27 (1,3)	463 (210)		750 (340)
Powerplant(s)			**Performances**						
Manufacturer	**Type**	**Poser** cv/kgp	**Vit. maxi** (km/h)	**Vit. crois.** (km/h)	**Vit. mini.** (km/h)	**Taux mont.** ft/min (m/min)	**Rayon d'act.** (km)	**Plafond** ft (m)	
Hirth		60	186.4	136.7	56	2624	500		
Subaru	1.6l DD1c	58	(300)	(220)	(90)	(800)	(800)	?	

The "Delta" is completed in December 2003. Entirely constructed with light alloys and equipped with wing upward folding external sections, she is powered by a 2 stroke 60cv Hirth engine actuating a two-blade tractor propeller. The cooling is ensured by an air intake originally placed under and at the rear of the engine-cowling. In order to reduce its volume this last is fixed directly on the engine and not on the firewall.



The landing gear is bicycle type with a main nose gear wheel, retractable and directional, and a small "fixed" tail wheel. Two small outriggers are placed at the wing tips. The cockpit canopy, occupies all the vertical fin leading edge and the downward visibility is improved by two transparent intrados removable panels, situated on both sides of the cockpit floor. Control is ensured by two large elevons and a vertical rudder.

The first flight, lasting 20mn, is performed on October 26, 2004, from Peronne St Quentin airfield, in the north of France, with Verhees at the controls. The engine air intake is thereafter repositioned on the top forward engine-cowling. In this new configuration, she is displayed at the P.F.A. annual "Fun Rally", held in June-July 2005 at Kemble, where she is prized for her originality.

At the beginning of 2006, the motorization is modified by the installation of a 4-stroke 58cv Subaru engine, less fuel thirsty. The aircraft length is therefore reduced from 3,69m to 3,25m. Engine water-cooling system induces a cooler installation in place of the right-hand intrados transparent panel. The area of the sliding canopy transparent panel is also reduced. The "Delta" resumes her flights in July 2006.

The "Delta", with a 300 km/h top speed but gentle flight characteristics, is regularly displayed at air gatherings across Europe where her aerodynamic configuration attracts all the attention.

No diffusion, in a kit form or as a drawings set, is scheduled. In parallel with the "Delta" program, "Verhees Engineering" is offering its design competences to aircraft homebuilders.

Philippe Vigneron
<retrofitprsp@yahoo.com>

April 11, 2011

Hi Andy,

Thank you for your mail. I am a Brazilian hang glider pilot living in the Netherlands for more than 25 years. My passion is tailless foot-launched gliders. My most interesting job was in Germany developing a rigid wing (http://www.delta-club-82.com/bible/137-

hang-glider-axxess.htm). As an airplane engineer I worked mostly with sport aviation and I discovered TWITT in the internet by quotes from other websites or maybe just as a suggestion from Google. I have no running project but I have a desire to develop a foot launched rigid wing with the pilot in a prone position inside the wing such as the Horten Piernifero or Gunther Rochelt Flair. Therefore, I am gathering as much information as possible in similar projects and past experiences. Nice to have such a great forum for tailless flying machines, I am looking forward to the newsletters.

With best regards,

Mario Campanella
<mcc@xs4all.nl>

(ed. – This was in response to my welcome message when Mario joined TWITT.)

April 19,2011

Mr. Hoey:

I am a wildlife biologist wishing to build something similar to your turkey vulture, primarily for slope flying. Many of our flying sites here in western Colorado are very rough and rocky, which means that a material such as EPP is preferable to wood or fiberglass. This makes the tip feather modification you are using impractical for this area. Would a setup such as you used for the seagull work well enough for a model of an eagle or hawk?

Have you ever tried transparent under the wing vertical stabilizers? And, last question, is it possible to high start a model configured like the seagull? I see that you show only a situation where the plane is dropped from a mother ship.

I appreciate your time and reply.

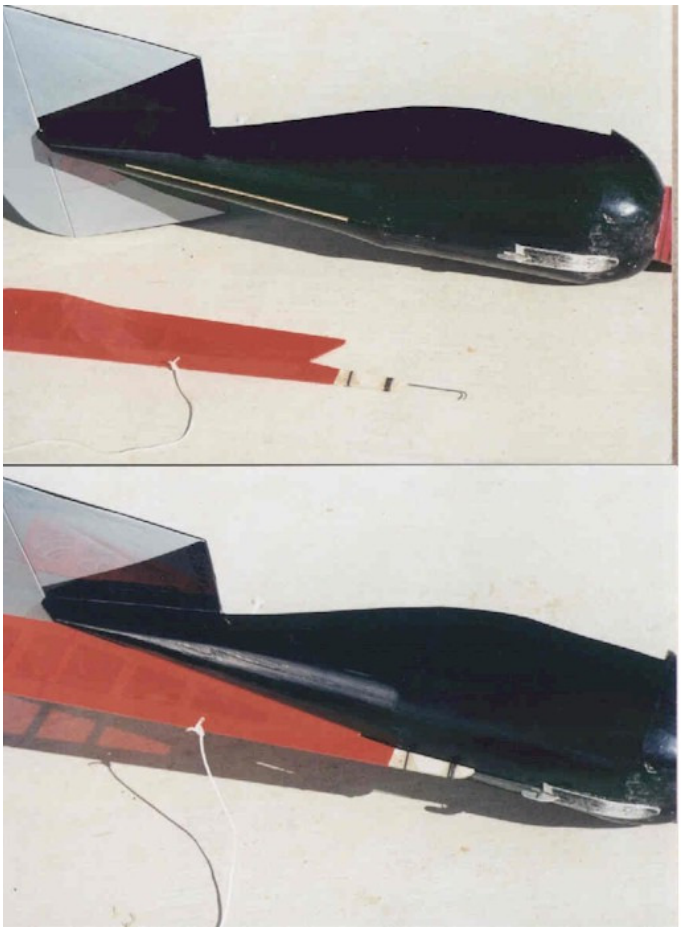
Jim Ferguson
Montrose, Colorado
<redtailenterprise@bresnan.net>

Hello, Jim,

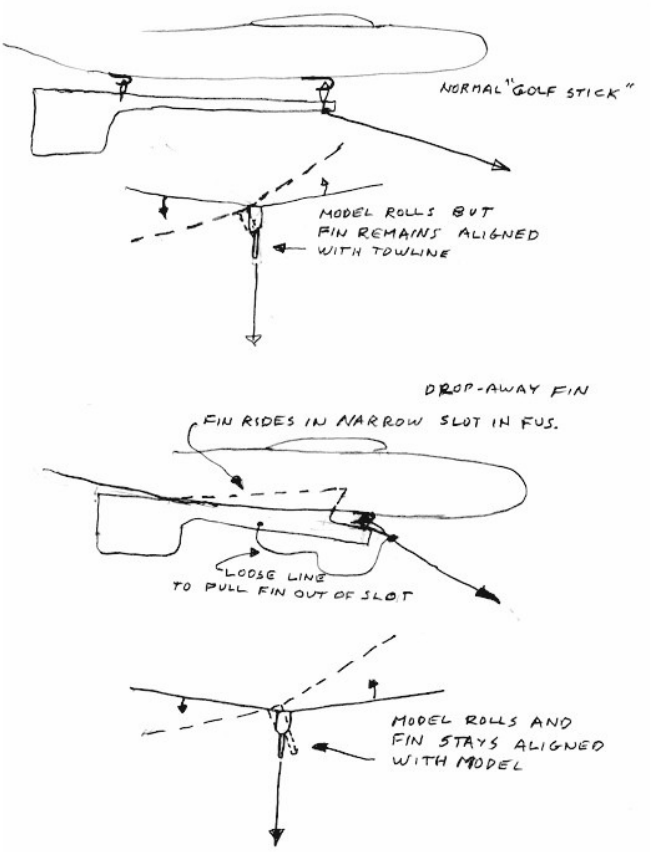
I assume you are referring to the seagull wing-tip aileron, which represents the entire wing tip rather than just the forward 3 feathers like the vulture and raven models.

I believe that such a scheme would work well. You may have to experiment with differential throws on the ailerons to reduce the adverse yaw. You probably should also introduce about 4 degrees of washout in the outer wing panel (from the wrist joint outboard) to create a smooth transition between the wing and the aileron when the proper bias position is established for each aileron.

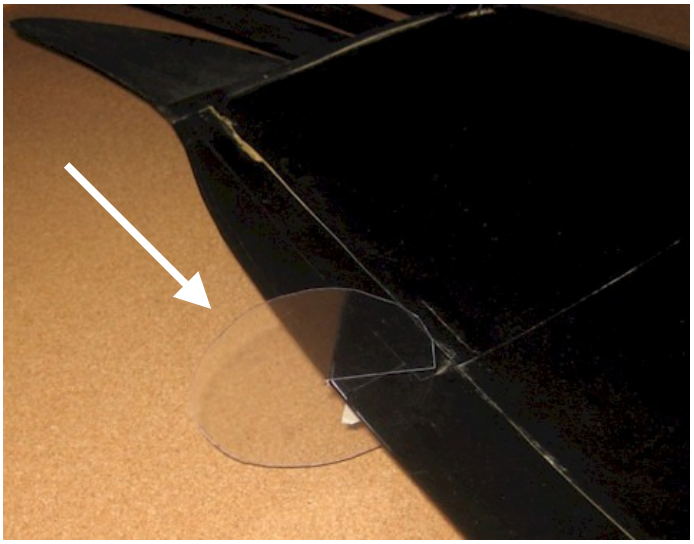
My initial goal was to try to understand the directional stability and aerodynamics of bird shapes without any vertical tails, so I was striving to eliminate vertical surfaces. Having said that, these experiments started with clear celluloid circular disks mounted about 3/4 of the way out on each wing near the trailing edge, and angled inboard at about 30 degrees. As flight-testing progressed, and dihedral and wing shape were adjusted, the disks were reduced in size and eventually eliminated. So, yes, transparent vertical stabilizers will work to increase directional stability. They do tend to reduce the amount of sideslip that is generated from aileron deflection somewhat, thus reducing the apparent aileron effectiveness for producing roll.

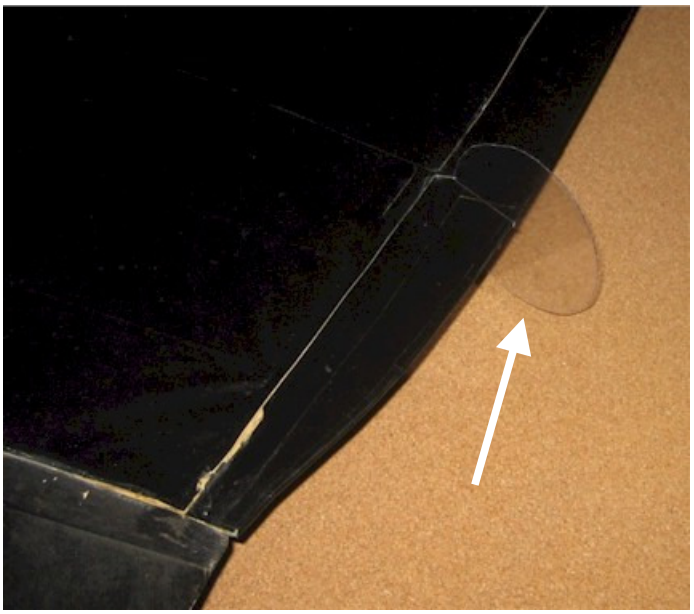


I have never attempted to high start the seagull model, but I suspect that it would have the same instability as the turkey vulture and raven. After about a year of experimenting (and repairing!) I found that the drop-away fin, described for the turkey vulture, does allow successful hi-starts. The secret seems to be to have the hi-start stabilizing fin not only remain aligned with the fuselage in yaw, but also in roll during the launch. That, is, a simple "golf stick" fin attached at the launch hook and also at the tail, but allowed to align itself with the tow line while the model is free to roll from one side to the other, doesn't solve the instability problem.



I have attached a sketch and a couple of photos that show the drop-away-fin that I have used on the Turkey Vulture and Raven with good results. I don't quite understand the dynamics of why keeping the fin aligned with the fuselage solves the lateral-directional oscillations, but it made a dramatic improvement in the high start launches. I'm pretty sure it would work with the Seagull too. I've also attached a couple of photos of the stabilizing fins near the wing tip that I usually use when flying a new bird design. (Hard to get a good photo of a clear plastic disc, but I think you'll get the idea.) A clear fin on the top (above the tail) would also work, I'm sure, but just be aware that the birds are using sideslip, and the resulting dihedral effect, to initiate turns, and if you stiffen up the yaw axis too much you may have difficulty making turns. They do tend to fly like a plank, and are also short-coupled in pitch like a plank.





I'm not aware of any forum for bird-like sailplanes but have received a number of individual responses from modelers all over the world who have either built one of my designs, or one of their own designs. There are some very clever and innovative people interested in the subject!!

Hope this helps.

Good luck with your experiments, and keep me posted on your progress. I'll be glad to answer any further questions.

Bob Hoey

(ed. – My thanks to Bob for including TWITT in his correspondence with modelers interested in building bird models and furthering the experiments with this type of "aircraft".)

April 21, 2011

Dear Sirs:

We are "Planes and Engines" from Argentina . We have an original flying wing made by Dr Reimar Horten in Argentina together with a group of pilots and enthusiast as an improved version of his H - 1 model . He called this model H - 1 - B and was the only one made.

The wing was always kept inside a hangar. It has not flown since 1972 when it was stored inside the air club hangar. The original Horten design was modified by him to this improved version of the H1 wing. The wing was mainly built in Gonzales Chavez city by Dany Dekker, Francisco Fernandez, Felix Hetcht, of course Dr Reimar Horten and Roberto Vilchez who passed away in 1955 and the rest of the group named the wing with his name.

In 2007, a group leaded by the pilot Diego Roldan Knôllinger decided on restoring the wing thinking in having it finished for the "1st American Continental Gliding Championship" which would be coinciding with the "55th National Gliding Championship".

Finally, the restoration was finished and successful and the wing flew again after 36 year on 1 February 2008 during the show. The pilot at the show was Diego Roldan Knôllinger.

The air club consigned us to sell the wing because they need a glider for the school. We need to get US$ 90,000 for it.

I´m attaching some movies of the wing flying and the last link shows many pictures during the restoration process. If you were interested in it please contact us for more information.

Thank you very much for your help. Any help will be welcome. We are not hurry to sell it so no problem if you want to publish it in the newsletter. It is great to find people around the world who want to help you. I´ll try to keep you informed about the destiny of the wing.

Regards.

Ricardo Birsa
President
Planes and Engines
Corrientes 105, General Pacheco (1617)
Buenos Aires, Argentina
<planesandengines@gmail.com>

http://www.youtube.com/watch?v=UVnwPEnSLuM&feature=related

http://www.youtube.com/watch?v=d3ceUvOOLiE&feature=related

http://www.youtube.com/watch?v=AJso4Rho3ek&feature=related

http://picasaweb.google.com/by.charly/HortenHo1B

April 29, 2011

Hi:

My name is Roberto and I live in the south of Spain. I want to do a Stabiloplan. Can you send me any plan in any format...dxf...pdf...Cad...?

Thanks!

Roberto Ruggiero
<robertoruggiero790@hotmail.com>

(ed. – I know this is not quite a flying wing, but I know some of our members have very diverse interests and might just have what Roberto is looking for. If so, contact him directly and make the necessary arrangements.)

(ed. – This short message started a long thread related to the Klingberg wing. I have included those messages that contribute to a discussion of the merits or faults of the design.)

May 2, 2011

http://www.youtube.com/watch?v=uzlJkFZKCzc&feature=channel_video_title

Paul Westrup
<p_westrup@hotmail.com>

Nice find, Paul.

I heard it really didn't fly much after that. The oral tradition holds that all the problems in the RC 2m Klingbergs manifested themselves in the full-scale version, and it wasn't very pleasant to fly (lots of Dutch-roll).

Al Bowers
<albion.h.bowers@nasa.gov>
Associate Director for Research
NASA Dryden Flight Research Center

I am remembering that there was a rather horrific accident with the Klingberg 'wing which resulted in severe injuries to the pilot. I'm also remembering a still photo taken from the left rear while the wing was in flight which showed large distortions of the covering on the upper wing surface near the wing tips. Major air flow separation at that point on the wing would have made controlled flight difficult or impossible, particularly if the distortion was intermittent.

Am I remembering correctly?

Bill & Bunny Kuhlman
<bsquared@centurytel.net>

You have more info than I do. I never saw the picture. If you find it, a scan would be priceless...

I find it interesting that so many of these great ideas got derailed at some point or another. The Moyes version of the H Xc. The Rochelt wing. The Klingberg.

I note that the ones that got sorted well also did very well, notably the Swift and the Millenium.

We can all play "what if" but history is what it is...

Al Bowers

More info here too...

http://www.delta-club-82.com/bible/660-hang-glider-klingberg.htm

Paul

I hope this URL doesn't get truncated:

<http://www.homebuiltairplanes.com/forums/aircraft-design-aerodynamics-new-technology/6524-stability-swept-wing-no-washout-elevons-alone-21.html#post98766>

Norm Masters
<nmasters@acsol.net>

The link came through fine. As did Mr. Klingberg's message.

Well, I disagree with Mr. Klingberg. If he truly did have a true bell-shaped lift distribution (I would love to see the data and analysis by which he developed his wing), then it would not have any issues with adverse yaw. And any examination of the footage of Horten flying wings would show they were ROCK SOLID in yaw (no beta). The German wings were very good in non-maneuvering flight, and the Argentine Horten wings were solid ALL the time (after Reimar sorted out the control input problem). Go look at the video of Diego Roldan's Ho-Ib flight, not a trace of adverse yaw.

Mr. Klingberg is correct that you can get a bell shaped lift distribution with careful planform, twist, washout, and airfoil selection. But I don't believe that the Klingberg wings got there. And two key give-aways that something was missing are 1/ spin behavior (the Klingberg wings require pilot technique to recover, no Horten wing required specialized technique to recover, just relax the back pressure on the stick and the wing recovered immediately) and the tip chord (Klingbergs had relatively large tip chords, Hortens had very small "pointed" tips).

I don't see how anyone could reverse engineer Horten's wings without going back to Prandtl's 1932 paper, or the papers by Jones (1950) and Klein/ Viswanathan (1975, well okay, maybe you don't need this one). Looking at Udens' data, it was clear that he understood the problem completely. It is clear to me that Reinhold Stadler also completely understands the problem. As do the PUL-9, PUL-10, and H-3000 designers.

I have shared my analysis and data, and I am willing to do so again. And as I have stated, I could not believe the data when I first calculated it. It took the unwavering belief of Mike Allen by building and flying a wing to convince me. And Mike's wing has no stall problems, no spin recovery issues at all, and has no adverse yaw (it too is rock solid).

It appears to me that something does happen in the dynamics as well. The true Horten wings seem to have a completely over-damped solid response to control input. There is no oscillation, not in any axis. I can't explain that (if I had the time I do have the tools to try and unravel the mystery)...

Al

(ed. – This is the last of the Klingberg thread but it had some other spinoffs that might be of interest.)

May 3, 2011

Apologies to all. My gray matter isn't what it used to be. Years ago we had a discussion of a German gentleman who was "experten" with the Eppler PROFILE code. He had a website and did a lot of work with RC sailplanes, designing custom airfoils for RC. I have done a few searches and can't find or recall his name. Does this ring any bells with our long-time contributors?

I've got the links for Drela's for the Apogee and Super Gee airfoils...

Thanks for any and all pointers...

Al Bowers

I got it:

REINHARD SIELEMANN!!!!

Apologies for the following rant: For those of you who don't know Sielemann, he's a GENIUS. Certainly on the scale of Drela or Selig, but he gets very little recognition. Especially here in the English speaking part of the world. But he has a skill with Profile, particularly at low Reynolds numbers, that is exquisite.

When I was doing my grad research with Profile, we did find it worked very well in attached flow all the way down to under Reynolds numbers of 5000 (I got decent results at Re=2000). I could never get Xfoil to work well for me (I will freely admit my experience with Xfoil is very limited!), its okay Mark still thinks of me as a friend of his. ;-) And I eventually got to design airfoils that would work at Re=20,000 or so. I wasn't a "wizard" at Reynolds numbers below that (I can do it, but I get REALLY conservative), but Sielemann is excellent at design down there. I can do analysis all the way down, but I am a neophyte at design with Profile, especially at low Reynolds numbers down there...

Al

Ha... LOL I have been mad at him for years. :-)

I built Hans-Jurgens CO7 HLG which use RS004a airfoil. I could never get the CG correct. I would go down at night to my local lit up soccer fields and balance until perfect, couldn't wait for morning and some lift. As soon as a hint of lift showed up the CO7 would loop instantly until I bit the bullet and moved the CG forward again, a LOT, like approaching an inch. All the down elev I had was not enough to stop it. This went on for six months before I trashed it.

A couple of years later I stumbled on http://www.aerodesign.de/english/index.htm

RS 004A
One of the newer creations for Swept Wings. Design by Sielemann <http://www.zanonia-flyers.de> /Hans-Ju"rgen Unverferth. Due to negative pitch moment a lot of washout is needed. I suppose same handling characteristics (something strange!) as tailless designs using SD7003 <http://www.aerodesign.de/profile/profile_n.htm#sd7003>.

This RS 004A has been used on CO8 and this model have had handling problems they never get rid of (Source: Sielemann). This was probably induced by the airfoil. They never managed their problems in flight stability around pitch axis. For a first attempt in low-cm pitch down airfoils it is not a good choice I think. SD7003 is a better choice to do this for the first time I guess.

Well, I guess I shouldn't be too mad at him anymore as I refused to build at the - 4 degrees of washout called for. I went with -2 and most likely compounded the unknown issues.

Regards

Dan Field
<danfield@roadrunner.com>

Mitchell U-2 Bulletin Board Threads

I found the link to a discussion of some experiments with flying wing models, which have no moveable surfaces. Control was maintained solely by twisting the surfaces.

The link is http://das-nurfluegelteam.de/ Click on "Steuerung durch Flächentorsion" {Control by twisting surfaces) It is in German, but the pictures alone are interesting.

The article is based on three powered glider models that were built and flown.

Here's a translation of the summary:
"An all-wing aircraft built on Horten principles can be controlled essentially without separate control surfaces, simply by twisting the flying surfaces. This method provided the tested models with a good pitch control, but a barely adequate roll control. With "torsion" control, the contradiction between the need for construction that is twistable and yet stiff and strong in bending. It is not easy to find an optimum between a too weak (FlexNF1) and a too torsion-resistant (FlexNF2) structure. From this it is clear that the control method would not permit a heavily loadable and very maneuverable stunt-type sailplane. Nevertheless, it could be quite applicable for light thermaling flying wings. The control method described is applicable to flexibly-covered rib-type construction as well as balsa-planked foam surfaces. The torque tube, necessary in any case, should be very stiff, and could serve double duty as a wing spar."

Dave G.
<dgingerich@cox.net>

(ed. – Here are some pictures form the web site noted in the letter.)

Anyone interested in a set of A-10 wings, landing gear, two place steering yoke located in Ohio for $850? Respond here, E-mail me at Dmoadus@Danmoadus.org or call me at 300-550-0154. I have every thing but the trike and engine.

Dan
<dmoadus@danmoadus.org>

I am getting ready to build a bunch of parts over in Africa that I'll be bringing back to the States with me via checked baggage. As such Aircraft Spruce will be getting a big order from me soon. After perusing the plans for smaller parts that I can make, I've come up with an order list, but I have a few questions...

What is the thickness of the #0 Nose Rib shown on Sheet 13?

Speaking of nose ribs, am I supposed to cut out the center of these ribs along the dashed line shown on Sheets 13&14?

For the mixer box/control stick stuff, I notice some of the stuff is aluminum, and some is steel. To make things easier, and lighter, would it be permissible to simply use all aluminum (6160T6) with this?

I notice in several places, a choice is given between using 6061T6 and 2024T3, but in some cases only one type is specified. It looks like given a choice, 6061T6 would probably be the better choice. I'm curious if 6061T6 can be used in all cases instead of 2024T3.

I'm sure I'll have more questions when it comes time to start doing work. The plan is to build the rudders, fabricate the stabilator ribs, nose ribs and most of the metal parts. I'll probably assemble the mixer box as well. That should give me a head start for building the bigger stuff (like the wings!!).

Andy Gamache
<andyomigosh@juno.com>

Hello Andy,
Upon reading your post, I thought you might be interested in a completed mixer box that I have been saving as a souvenir from my worn out B-10. It's a beautiful, complex piece of machinery, but other than a few pilots no one but me particularly appreciates it so I could be persuaded to sell it for say, $100, if it would help you. I don't know for sure if it's the same for a B-10 and a U-2. Perhaps someone else may have that answer.

Richard Sherlock
<richsherlock1@yahoo.com>

AVAILABLE PLANS & REFERENCE MATERIAL

Coming Soon: Tailless Aircraft Bibliography Edition 1-g

Edition 1-f, which is sold out, contained over 5600 annotated tailless aircraft and related listings: reports, papers, books, articles, patents, etc. of 1867 - present, listed chronologically and supported by introductory material, 3 Appendices, and other helpful information. Historical overview. Information on sources, location and acquisition of material. Alphabetical listing of 370 creators of tailless and related aircraft, including dates and configurations. More. Only a limited number printed. Not cross referenced: 342 pages. It was spiral bound in plain black vinyl. By far the largest ever of its kind - a unique source of hardcore information.

But don't despair, Edition 1-g is in the works and will be bigger and better than ever. It will also include a very extensive listing of the relevant U.S. patents, which may be the most comprehensive one ever put together. A publication date has not been set yet, so check back here once in a while.

Prices: To Be Announced

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Books by Bruce Carmichael:
Personal Aircraft Drag Reduction: $30 pp + $17 postage outside USA: Low drag R&D history, laminar aircraft design, 300 mph on 100 hp.
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Bruce Carmichael brucehcarmichael@aol.com
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VIDEOS AND AUDIO TAPES

(ed. – These videos are also now available on DVD, at the buyer's choice.)

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VHS tape of Al Bowers' September 19, 1998 presentation on "The Horten H X Series: Ultra Light Flying Wing Sailplanes." The package includes Al's 20 pages of slides so you won't have to squint at the TV screen trying to read what he is explaining. This was an excellent presentation covering Horten history and an analysis of bell and elliptical lift distributions.

Cost: $10.00 postage paid
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VHS tape of July 15, 2000 presentation by Stefanie Brochocki on the design history of the BKB-1 (Brochocki,Kasper,Bodek) as related by her father Stefan. The second part of this program was conducted by Henry Jex on the design and flights of the radio controlled Quetzalcoatlus northropi (pterodactyl) used in the Smithsonian IMAX film. This was an Aerovironment project led by Dr. Paul MacCready.

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An Overview of Composite Design Properties, by Alex Kozloff, as presented at the TWITT Meeting 3/19/94. Includes pamphlet of charts and graphs on composite characteristics, and audio cassette tape of Alex's presentation explaining the material.

Cost: $5.00 postage paid
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VHS of Paul MacCready's presentation on March 21,1998, covering his experiences with flying wings and how flying wings occur in nature. Tape includes Aerovironment's "Doing More With Much Less", and the presentations by Rudy Opitz, Dez George-Falvy and Jim Marske at the 1997 Flying Wing Symposiums at Harris Hill, plus some other miscellaneous "stuff".

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(ed. – Here are a couple of pictures from a few years of back issues to fill in the space knowing you all like pictures of flying wings and birds.)