No. 332 FEBRUARY 2014

T.W.I.T.T. NEWSLETTER

Wolfgangs's Mitchell U2

Source: http://www.homebuiltairplanes.com/forums/aircraft-design-aerodynamics-new-technology/5088-flying-wing-questions.html

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

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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.

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

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PRESIDENT'S CORNER

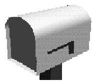
This was a good month in that I had two really great articles to publish so there is a full issue with lots of pictures and I know how much you like pictures. My thanks to Bob Hoey and John Newton.

We had some bad/good news about Peter Selinger. He suffered a heart attack but was treated quickly and we understand he is now recovering at home. We wish him the best.

I also got in a link to a YouTube video of the Facet Opal by Scott Winton. I don't recall ever seeing this one before or anyone else mentioning that is was available on-line. If you don't have an Internet connection, take your newsletter to the library and type it in. I think you will enjoy what you see since most of it is air-to-air shots of if performing very well.

The weather in San Diego cooperated in early January and I was able to get my 1-26 painted. Here is what the final results look like. Now to just get it licensed and in the air.

Andy



LETTERS TO THE EDITOR

(ed. – This just came in as I was editing the final version of the newsletter. It is a six-minute video narrated by Scott Winton and includes a lot of remarkable flying shots. Well worth the time to watch.)

Hi, This is an old video of Scott Winton's Opel flying wing.

https://www.youtube.com/watch?v=h2wrSa8mCcI

Perhaps you may wish to add it to your fantastic site?

Cheers,

Colin Hopkins

Does anyone have pictures, data, dimensions on Barnaby Wainfan's FMX-5 model?

I am particularly looking for photos of the bottom / backside and wingtip droop relative to the central part of the fuselage. All attempts for contact with Wainfan have been met with silence.

To my knowledge very little has been done with this design for the last 20 years. I am tired of waiting for something that may never happen.

Dave Barker
Spokane, WA
david_barker@msn.com
Ph. 509 921 8980

(ed. – If anyone has this information and is willing to pass it along to Dave, please copy TWITT so we can pass it along to others that have a passing interest in Barnaby's work.)

All, happy New Year and enjoy this short video (5.5 minutes).

The late Paul MacCready noted in one of his presentations that humans and their cattle now constitute 98% of vertebrate animal mass on the planet. Wild creatures, including these precious birds, and other threatened species such as mountain gorillas, thus now stand at 2%, likely falling.

Enjoy these birds while we still can. If you are so inclined, contribute to your preferred wildlife/ habitat conservancy, and/or related university research, such as that representing this video. If that cannot prevent the inevitable, perhaps it will at least help to delay it.

https://www.youtube.com/embed/REP4S0uqEOc

Phil Barnes
pelicanag@aol.com

(ed. – This includes some beautiful photography of our avian friends. Well worth the few minutes of viewing time.)

Hi Al (Bowers),

Really enjoyed your talk at the AMA Expo last week. You are to be commended on two counts; the success of the Prandtl wing and proverse yaw demo, and your success in bringing the younger engineers into the effort. It brought to mind a research project that I started several years ago, but never really finished; the potential advantages of a variable planform wing. I have attached a couple of files from some of my earlier presentations that describe what happened. This was several years ago, before the advent of tiny instrumentation units and micro servos, etc.

The full-scale airplanes with swing-wings are primarily aimed at transonic and supersonic flight, but there are some potential advantages of a variable-planform wing for low speed flight as well, particularly for gliders. One rather subtle advantage is the fact that the reduced lift curve slope and reduced area result in the wing angle of attack remaining fairly constant (near optimum) for the retracted wing config. I thought it might be possible to turn the younger crowd loose on the design of a demonstrator vehicle, along the lines of your Prandtl wing, to validate the concept. It need not be a bird shape.

It may have already been done - I didn't do the research.

Just a thought,
What do you think?

Bob Hoey

(ed. – Bob hadn't heard back from Al at the time this was published, but thought it might stir up some interest within the TWITT group. I have included the files Bob mentioned below. Let me know and I will pass your comments on to Al and Bob.)

RAVEN 4 FLIGHT TEST RESULTS

(1) Non-reflexed airfoil required LARGE trim elevator deflection
- Needs new wing with better airfoil

(2) AC moved forward ½ inch with wing retraction
- Corrected with minor linkage adjustment

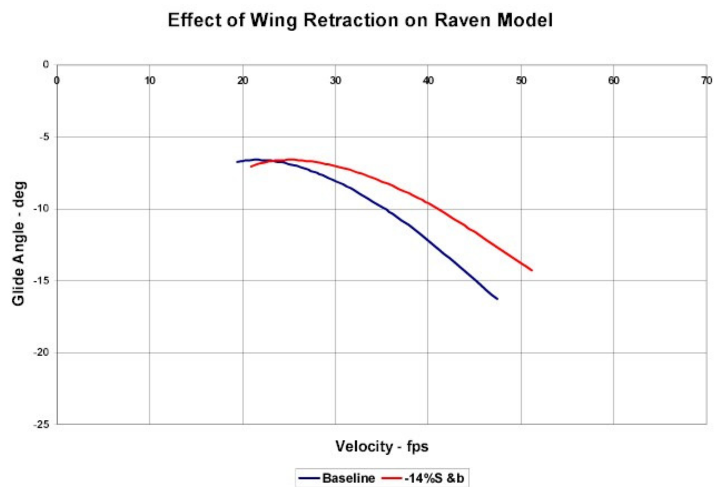
(3) In-Flight wing movement required unloading the wing slightly
- Need a jack-screw drive mechanism

(4) Wing structure awkward, but strong

THE CONCEPT WORKED
- Glide fast and fairly flat in both configurations

HOWEVER,
- NO obvious performance change with wing position

Variable Geometry Wing



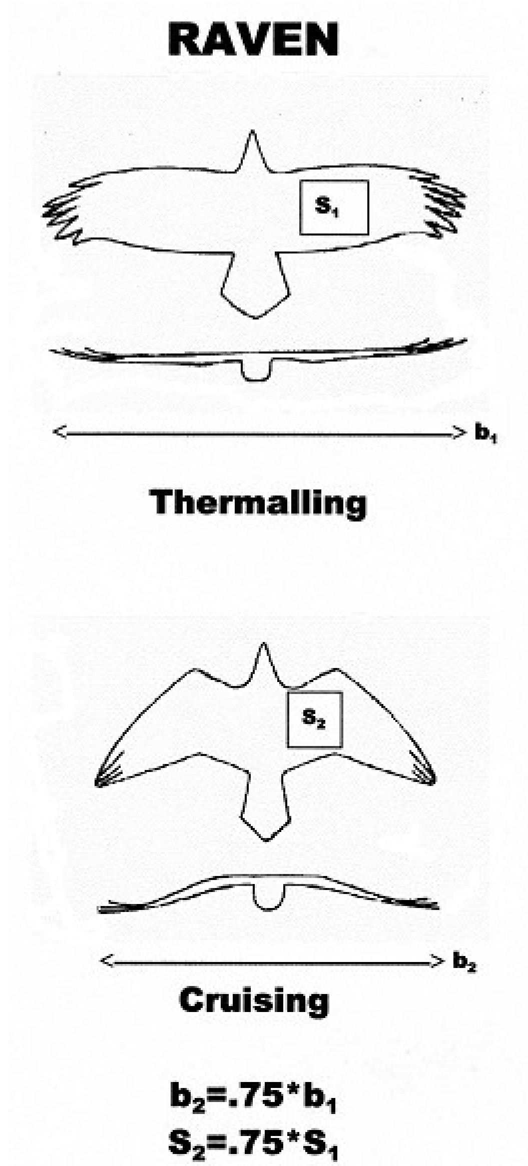
Weight/Span/Area Effects

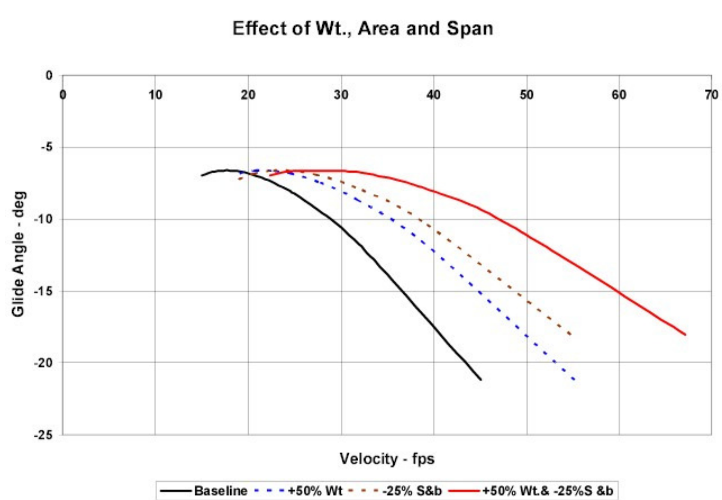
All of the work discussed thus far has dealt with stability and control. The performance (lift and drag) of a radio-controlled glider is extremely difficult to measure, but some observations and simple calculations are possible. While flying the model in thermals with other Ravens I have noticed that there is very little performance difference between my model and the real Ravens, even though the model wing loading is only about half of that of a real Raven. They circle at about the same speed and bank angle, and seem to climb at about the same rate. When the real Ravens decide to leave the thermal and fly straight, however, there is a dramatic difference. My model is no match for the high speed and shallow glide angle that the birds can achieve in straight flight.

Based on photos and observations, it is estimated that both the wing span and wing area of a Raven in straight cruising flight are reduced by about 25% compared with the thermalling configuration (Fig. 1).

The standard lift and drag equations (including the change in lift curve slope due to the change in aspect ratio, Ref. 3) were used to analyze the effect of a 25% change in span and area. The effect of the lower weight of the model was also analyzed. The cumulative effect was quite dramatic, and explained the observed performance differences between my model and the real birds. Configured for high speed flight, real ravens can fly 67% faster than my model at the same glide angle, or they can glide at about half the glide angle at the same speed. Of course they can change back to the thermal configuration (or anything in-between) with literally, a "flick of the wrist".

Producing a practical mechanism for changing the geometry in flight proved to be quite a challenge. The practical aspects constrained my model to only a 14% change in span and area. Recalculating the span and area effects for the two achievable shapes resulted in a fairly small predicted performance change as shown below.





FYI:

Our mutual friend, Peter Selinger, has suffered a heart attack over the holidays. He is apparently doing well and recovering in a clinic at Lake Constance.

Here's to hoping he recovers quickly!

Al Bowers

(ed. – This came in mid-January so I am assuming he has returned home from the hospital. Our best wishes for a full recovery.)

At the link below I have begun to explore a tiny plank style flying wing.

http://www.homebuiltairplanes.com/forums/aircraft-design-aerodynamics-new-technology/17408-characteristics-straight-wing-tailless-model-langley-free-flight-tunnel.html

I am wondering if anyone in your membership, to the best of your knowledge, has analyzed a similar planform and scale.

The basic idea is to use a structure like the Leeon Davis DA-11 to construct an aircraft like the Scott Winton Facet Opal.

Gross weight between 345 and 375 pounds. Wing area 32 square feet. Wing span 12 feet 9 inches.

I have no doubt the size and weight will fly since the DA-11 flew. The major question is what will the pilot feel - will stick feedback encourage or discourage the pilot?

Of course, I realize that this is not an optimal flying wing. Perhaps it is a good compromise.

Thank you for taking time to read this and please alert your membership to the discussion at the link above.

Nick Cafarelli
nickec@gmail.com

Dear TWITT members,

I thought I would write to tell you all how I am progressing with my latest project, A Horten/Prandtl style flying wing with a bell shaped lift distribution and no fins. The final design will be a 2.2m wingspan 1.75Kg R/C glider with a small brushless pusher motor and folding prop for power to avoid the need for a bungee (hi-start) launch. XFLR5 was used to set the correct planform and twist on each section to produce the desired bell shaped lift distribution at the trimmed (design) flight speed.

Owing to the thinness of the tip airfoil I have chosen to build the wing from hot wire cut foam with a fiberglass covering. As I had not attempted this before I thought it wise to build a 60% scale version (1.32m span) of the wing to test out this construction technique. The wing semi span is built of 3 sections of foam, which are joined and then the whole covered with fiberglass.

The ideal opportunity arose when the University I work for required some models made to feature in a display on Computational Fluid Dynamics analysis, as an added bonus I got to carry out some analysis on the wing itself using Star CMM+ software. At 2.2m span the CFD analysis predicted a L/D ratio of 16 which sounds fairly promising given the fairly low aspect ratio (XFLR5 predicted 21.8).

The finished wing semi span was mounted on a poster illustrating the airflow over the wing at the design airspeed as analyzed using Star CMM+.

I wanted to avoid the need to use epoxy resin and vac bagging to keep the process clean, quick and simple and therefore used Eze-Kote water based resin from Deluxe Materials. I must say I am very pleased with the results. One thing I have found is that the fiberglass will shrink slightly on application and therefore fiberglass layers should be added to the top and bottom surface of the wing simultaneously to avoid the tips warping.

Where ply and balsa was added to the wing for reinforcement Aero-bond contact adhesive from Deluxe Materials was used, this is also water soluble (very similar to copydex).

The process was basically as follows:

- Laser cut 1.5mm ply upper and lower rib profile templates and plan view of each wing section. The rib templates have marks on showing leading, ¼ chord and trailing edge location to aid alignment.
- Cut foam blanks accurately using the section plan views.

- Mark ¼ chord line on top, bottom and sides of foam blanks using pen to assist lining up of templates and wing sections.

- Temporarily attach lower airfoil templates to foam sections using glue gun and hot wire cut ensuring plenty of weight is used to hold foam blank in place. Peel off templates when done.

- Repeat for upper airfoil profile.

- Glue lower section of blanks together using a glue gun to form a lower mould.

- Place plastic sheeting over lower mould.

- Using lower mould as an aid to align sections glue wing sections together using glue gun.

- You will need to install any servo wires, strengthening plates etc. at this stage., strengthening plates were inset into wing surface using a thin metal rule to compress the foam where they were to sit.

- Lightly sand the wing.

- Add 50g/m (I believe, this was an off cut given to me) fiberglass sheet over the outer 1/3rd of the semi span, the sheet should be wrapped around the leading edge and brought together over the trailing edge.

- Add 50g/m fiberglass sheet over entire wing using water based resin and allow to dry, the sheet should be wrapped around the leading edge and brought together over the trailing edge.

- Lightly sand the wing.

- Add 50g/m another fiberglass sheet over entire wing using water based resin and allow to dry, the sheet should be wrapped around the leading edge and brought together over the trailing edge.

- Coat the wing in foam friendly water based gloss paint, I found brush on Plasticote (not the aerosol version) the best.

I cut the foam by hand using a home made bow, having said this a feather cut system (using pulleys and a lever arm to follow the taper precisely) would give a more precise finish. A key component is the design of the rib templates, the lead in and lead out must be a smooth curve and I thickened the trailing edge of the ribs to prevent the foam in this area melting away to nothing, it was then compressed back to the correct sharp profile prior to fiber glassing.

Cutting the leading edge accurately proved hard due to the rapid change in curvature and small radii, therefore the next set of templates I make I will modify the leading edge shape to make it a smoother lead-in and then sand it back to the correct profile afterwards (see attached diagram).

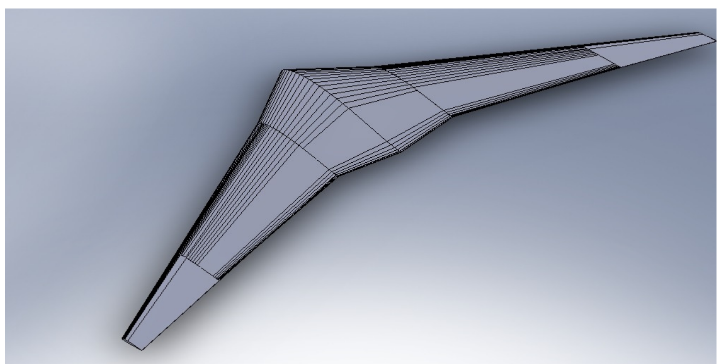
The total weight of the finished wing half including paint came to just under 90 grams, not bad if I say so myself. The wing itself is very rigid and my next plan is to build an entire wing in this fashion equipped with elevon servos for some test flights.

I am still in the process of learning Star CMM+ but hope to use it to further investigate the aerodynamics of my wing with the final goal being to compare these results with the flying prototype. I also hope to use a flight data recorder to analyze the proverse/adverse yaw characteristics.

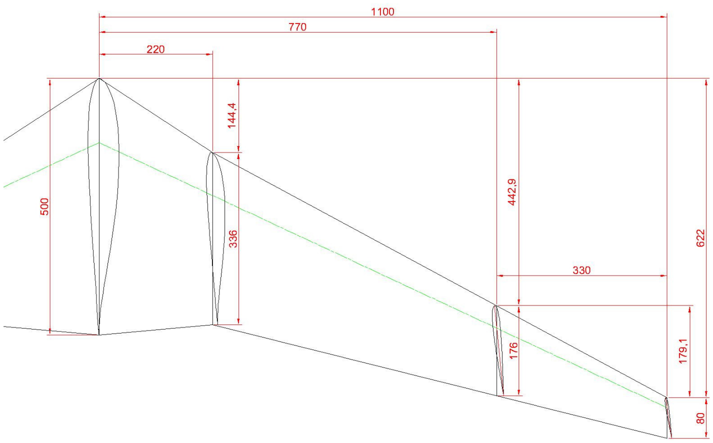
Thanks again to all group members for your invaluable help and advice.

John Newton
United Kingdom

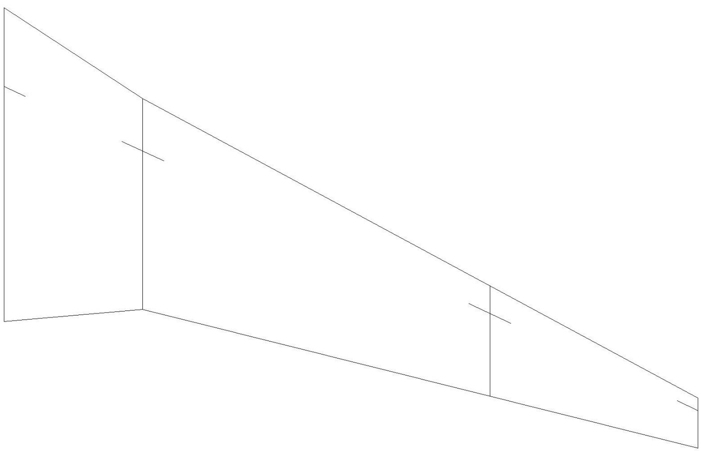
(ed. – John included a large number of images covering the process and analysis he has described above. I will put as many as I can below with whatever explanation is available in the image titles. The XFLR5 and CMM images are probably not going to be very meaningful in the printed version of the newsletter, but you can always bring up the electronic version from the website. The members only user ID and password are always located in the masthead of each issue.)



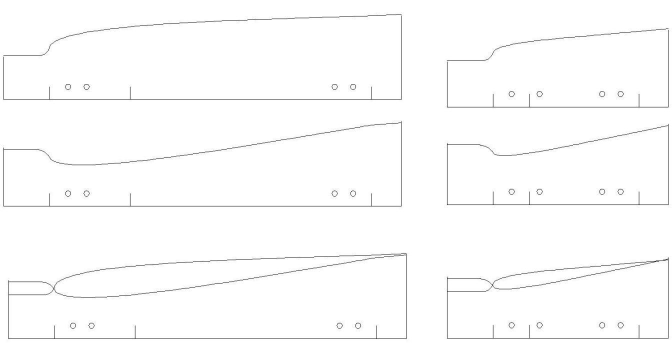
BSLD5g Solid Model



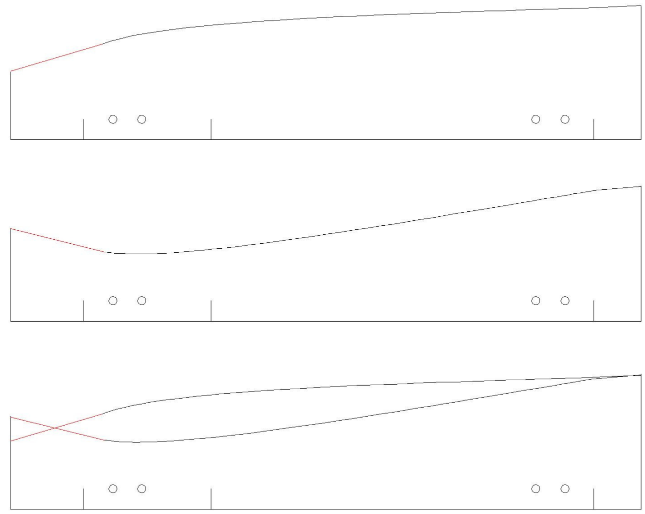
BSLD Wing Grid



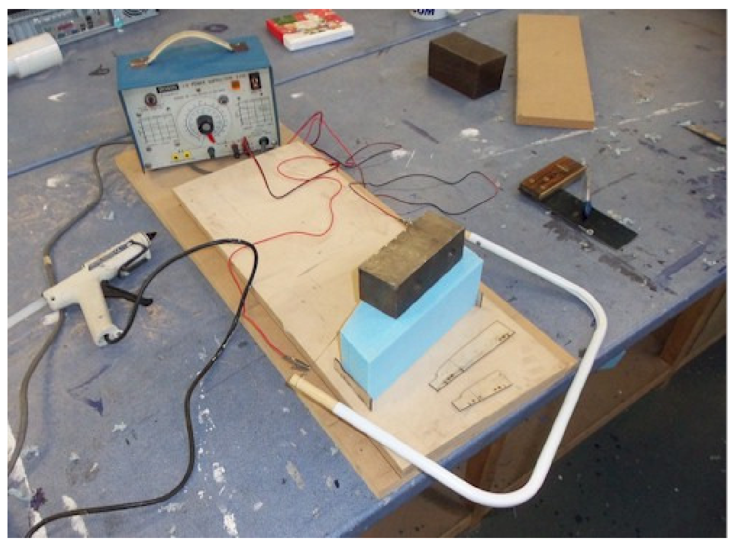
Wing Templates



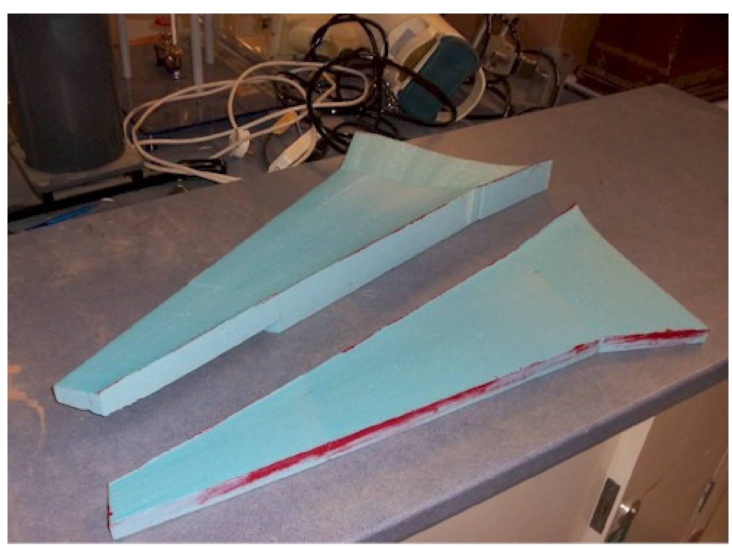
Rib Templates



Modified Templates



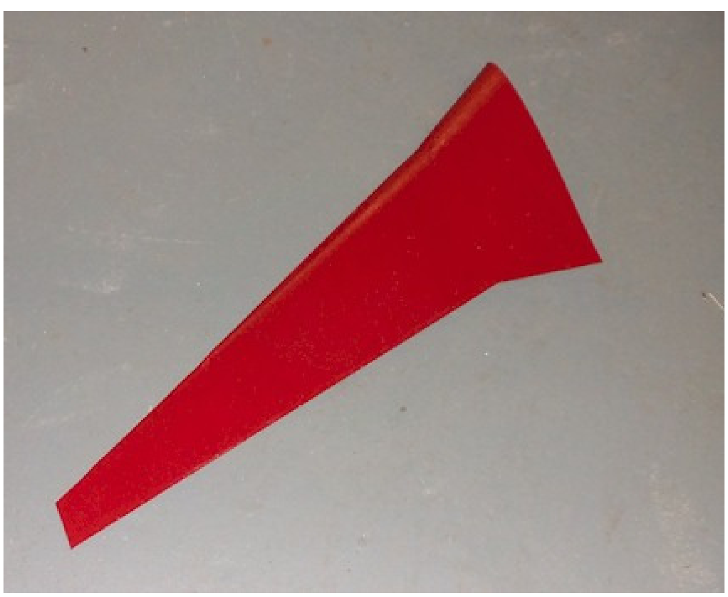
Foam Cutting Rig



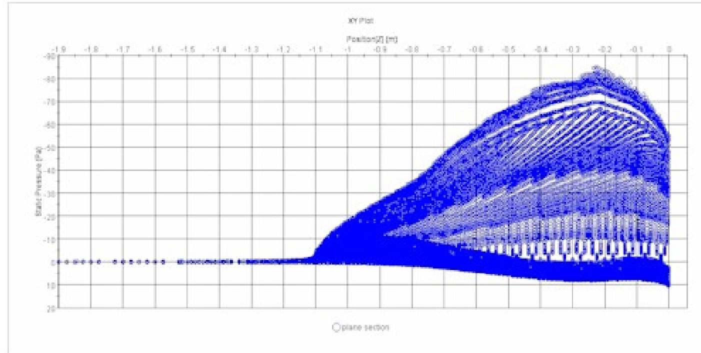
Outer Panels

Covered, Untrimmed Wing

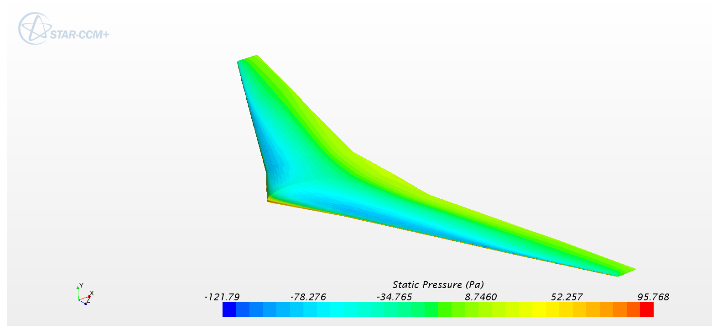
Covered Wing



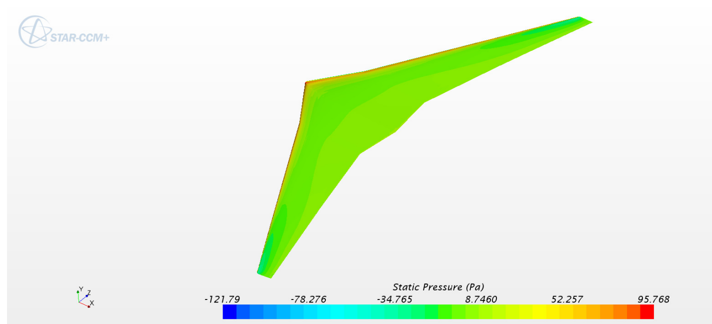
Painted Wing



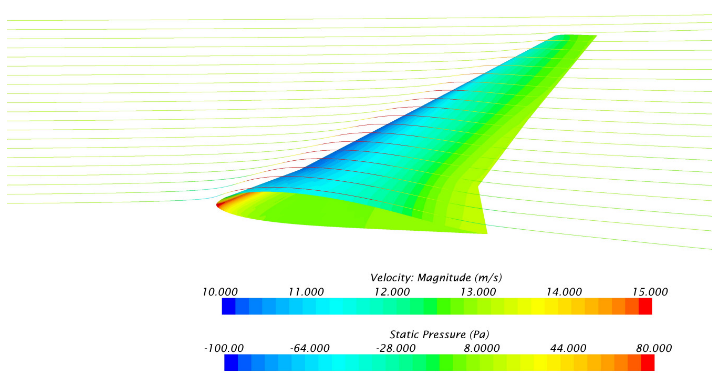
STAR CMM Span Wise Pressure Plot



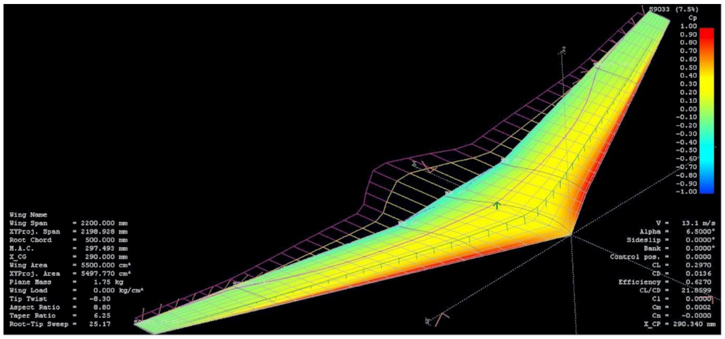
STAR CMM Full Size Surface Pressure



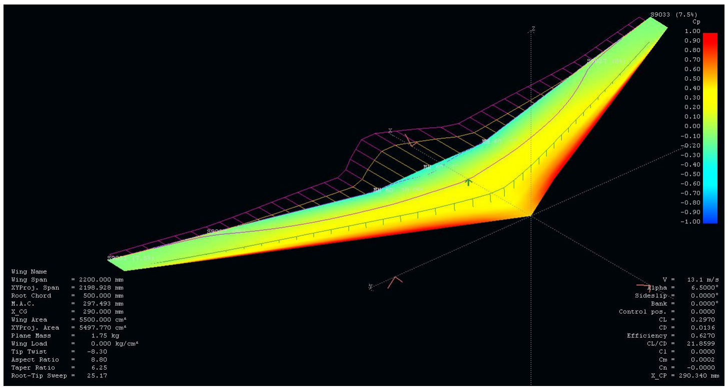
STAR CMM Full Size Surface Pressure – Bottom



STAR CCM Full Size Surface Pressure and Velocity



XFLR5



XFLR5 No Elevon Deflection

Nurflugel Threads

The ultimate R/C aircraft (X47B UCAS)? Amazing what you can do when you have an "unlimited" budget to play with.

http://www.youtube.com/embed/WC8U5_4lo2c?feature=player_embedded

Al, were you involved with this?

Laurel

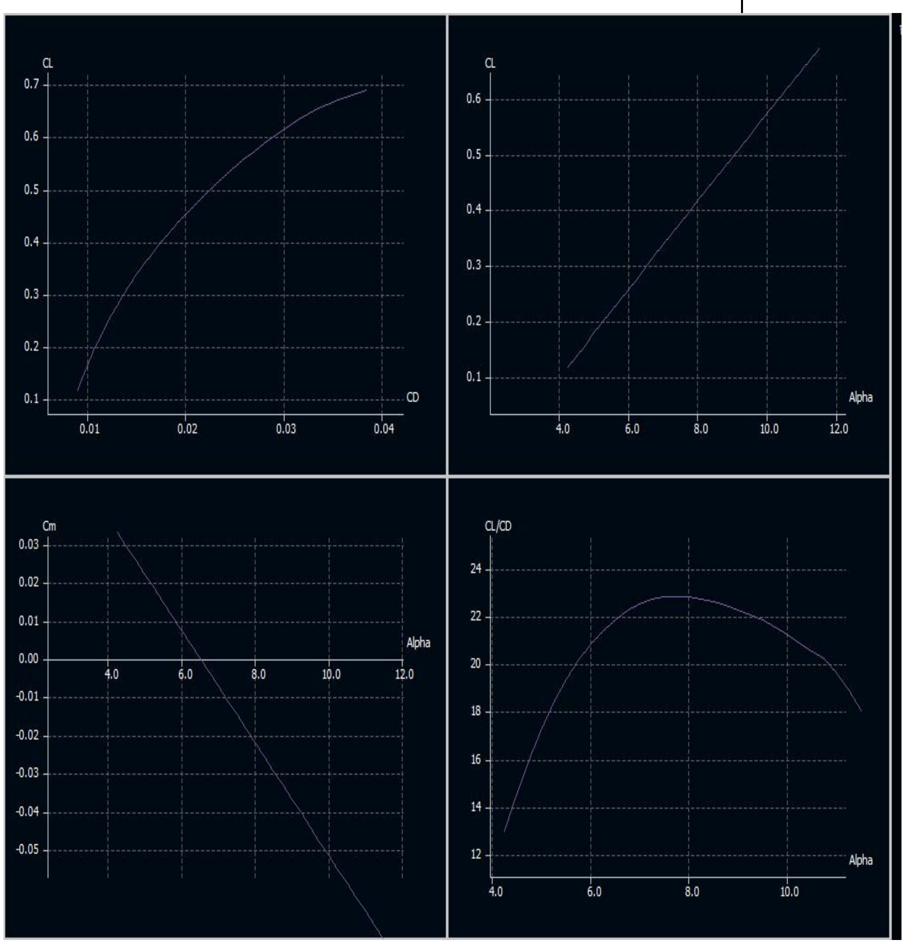
The control surfaces, and their deflections in relationship to what this thing is doing at that time, are most interesting indeed.

Steve Corbin

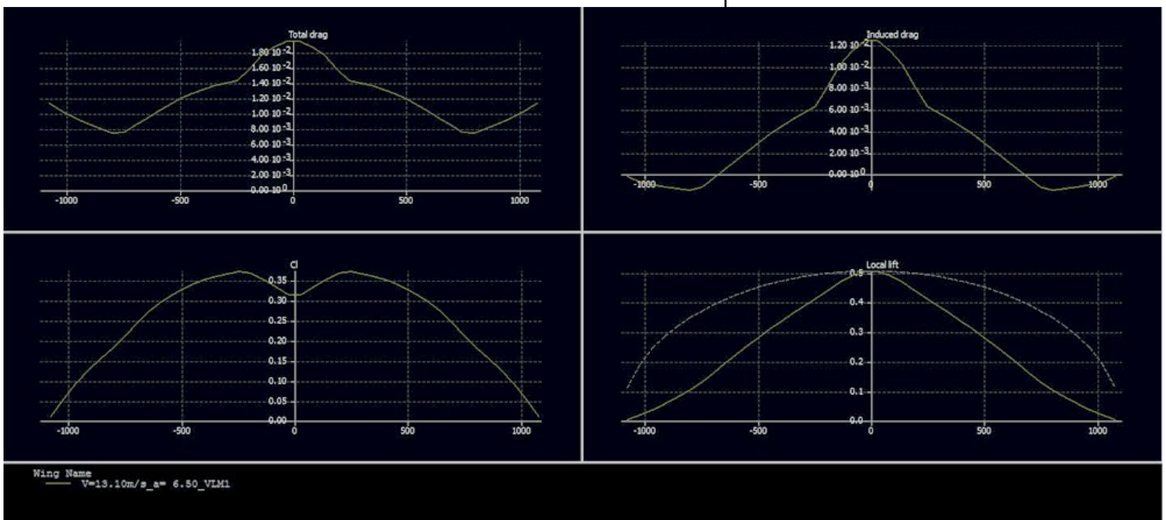
You noticed that too. What I noticed was the amount of control deflection, the speed at which they operated, and thought "this thing was designed to be highly maneuverable." Doing a little more research on the X47B it's designed as an unmanned combat air vehicle (hence UCAV) capable of .9 mach.. I noticed it was attached to a VF squadron- which is attack (fighter) squadron in Navy lingo. While this is not a small aircraft (62ft/19m wingspan- with an EW of 14000lb and MTOW of 44567lb/payload of 4500lbs ordinance) This one is just the demonstrator- a larger version (X47C) is planned with a wingspan of 172ft(52.4m). During that carrier test it was the first for an unmanned air vehicle to be carrier launched and made touch and go's. It made only one arrested landing on the carrier (another first) and the second arrested landing was aborted due to a computer (1 of 3) failure. Still pretty impressive, especially for a carrier environment.

Laurel

I just uploaded 2 scanned pages from a book regarding the late Dr. Karl Nickel's "Falter 1" flying wing ultralight design... in the photos section.



SFLR5 No Elevon Deflection Polars



SFLR5 No Elevon Deflection Graphs

Very interesting concept, but I can find very little additional information about it. It had the unique combination of:

- Wing warping control.
- No vertical surfaces
- Foldable like a hang glider wing
- Controlled side slips and co-coordinated turns

I would like to learn more about this design.

Does anyone in this group have more information about it?

Perhaps some features and/or lessons learned from it could be applicable to newer designs.

The book is "Tailless Aircraft in Theory and Practice" by Karl Nickel and Micheal Wohlfahrt .. I have the English language version published by AIAA... I think the German version is also available on the web.

Daniel Moser

I have a copy of this book, I remember reading the section about the Falter 1 and finding it very frustrating that there was so little information given on this aircraft, particularly given that large portions of the book are devoted to adverse yaw and here was a potential solution designed by the author himself. Even basic information seems nigh on impossible to come by. It is all the more frustrating as if it did fly as well as claimed it would make a very useful comparison study to the Horten style designs.

I look forward to hearing if you manage to get any further info.

Looking again at this it looks like the wing is rigid and fixed and the fuselage frame is rigidly mounted to the wing (i.e. no weight shift). The elevon control surfaces have two control horns on each of them, one at each end allowing them to be warped as well as raised and lowered. Presumably the elevons could be moved up and down together for pitch, oppositely for roll and then the warping applied to control yaw and/or induce pro-verse adverse yaw as required? I would love to know how they were mixed!

I may be wrong but that is what makes the most sense to me. I guess that using the warping elevons you can effectively control the twist and therefore lift distribution over the outer 1/3rd of the wing semi-span enabling yaw control.

Anyway, must get back to sanding some rib templates :-)

John Newton

Speculating from the pictures of the Falter 1 in the book, it looks to me as though the inboard control horn on one wing is deflected opposite to the outboard control horn on the other wing in aileron mode..
And in elevator mode, I suppose they work in unison.. but I have many questions on how the control linkages were designed.. And, he refers to control pedals as well.. what do they do?

I'd really like to learn how those controls were designed, how they worked, and what modifications or variations he tried out on this one-of-a-kind aircraft.
It seems a shame that we know so little about it.

The only thing I know of that was similar to the Falter 1 were the C model Kasperwing ultralights.

They 3-axis control with elevon-type controls that were hinged rather than warped (I'm not sure about this) .. it also had spoilers and vertical tip fin/rudder controls.

The C model was more expensive than the earlier A & B models, which had only weight shift & rudder control.
The company only made a few C models ~1987 before going out of business .. they never became very popular... I know of only one in existence today.

Daniel

AVAILABLE PLANS & REFERENCE MATERIAL

Tailless Aircraft Bibliography

My book containing several thousand annotated entries and appendices listing well over three hundred tailless designers/creators and their aircraft is no longer in print. I expect *eventually* to make available on disc a fairly comprehensive annotated and perhaps illustrated listing of pre-21st century tailless and related-interest aircraft documents in PDF format. Meanwhile, I will continue to provide information from my files to serious researchers. I'm sorry for the continuing delay, but life happens.

Serge Krauss, Jr. skrauss@ameritech.net
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Cleveland Hts., OH 44118 (216) 321-5743

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.
Ultralight & Light Self Launching Sailplanes: $20 pp: 23 ultralights, 16 lights, 18 sustainer engines, 56 self launch engines, history, safety, prop drag reduction, performance.
Collected Sailplane Articles & Soaring Mishaps: $30 pp: 72 articles incl. 6 misadventures, future predictions, ULSP, dynamic soaring, 20 years SHA workshop.
Collected Aircraft Performance Improvements: $30 pp: 14 articles, 7 lectures, Oshkosh Appraisal, AR-5 and VMAX Probe Drag Analysis, fuselage drag & propeller location studies.

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Capistrano Beach, CA 92624 (949) 496-5191

VIDEOS AND AUDIO TAPES

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

VHS tape containing First Flights "Flying Wings," Discovery Channel's The Wing Will Fly, and ME-163, SWIFT flight footage, Paragliding, and other miscellaneous items (approximately 3½+ hours of material).
Cost: $8.00 postage paid
Add: $2.00 for foreign postage

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
Add: $ 2.00 for foreign postage

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.
Cost: $8.00 postage paid
Add: $2.00 for foreign postage

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".
Cost: $8.00 postage paid in US
Add: $2.00 for foreign postage

VHS of Robert Hoey's presentation on November 20, 1999, covering his group's experimentation with radio controlled bird models being used to explore the control and performance parameters of birds. Tape comes with a complete set of the overhead slides used in the presentation.
Cost : $10.00 postage paid in US
$15.00 foreign orders

COMPANION AVIATION PUBLICATIONS

EXPERIMENTAL SOARING ASSOCIATION

The purpose of ESA is to foster progress in sailplane design and construction,which will produce the highest return in performance and safety for a given investment by the builder. They encourage innovation and builder cooperation as a means of achieving their goal. Membership Dues: (payable in U.S. currency)

United States	$20 /yr	Canada	$25 /yr
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