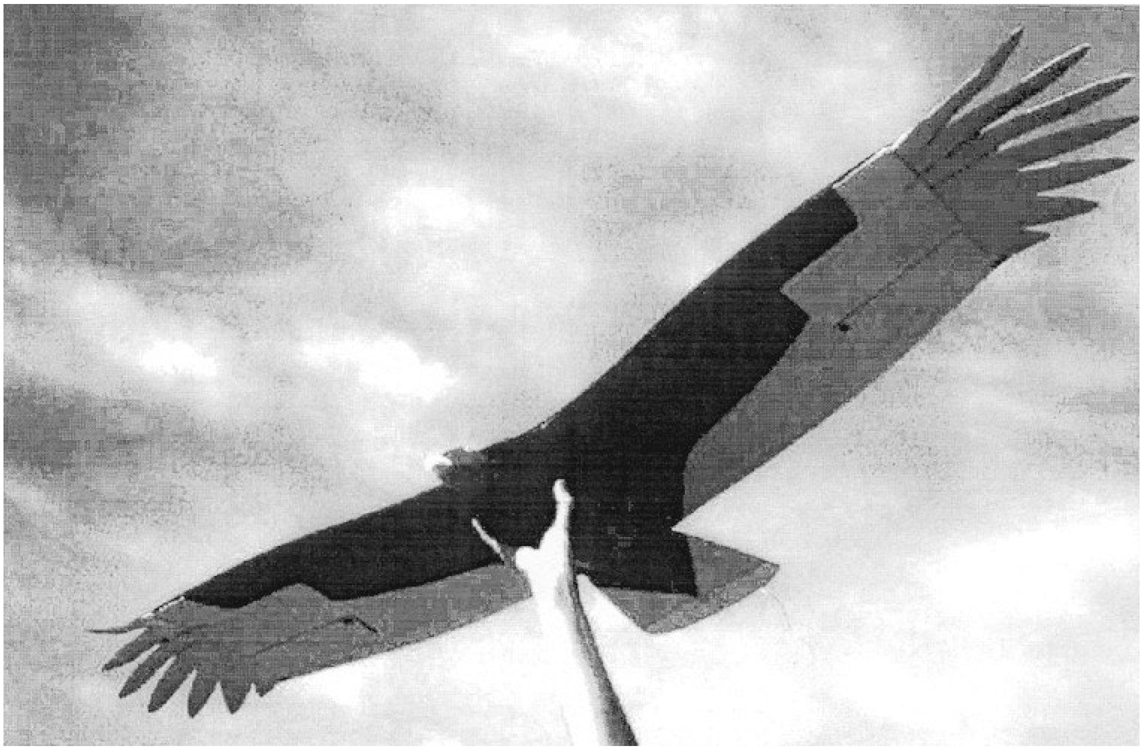
No. 161 NOVEMBER 1999

T.W.I.T.T. NEWSLETTER



Example of Bob Hoey's R/C experimental model. See page 2 inside for more.

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., **9911** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, November 20, 1999, 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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1oz/1	1.00	1.00	1.00
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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

Thanks go to those of you who gave me some feedback on why we may be having troubles retaining members. If you have some opinions and just haven't had time to put them in writing yet, please do so at any time and mail them to me. Our goal is to maintain a vibrant, growing organization that can further the development of all types of flying wing aircraft.

Some of the comments so far have had to do with the impact of the web site. I find this both encouraging and disheartening at the same time. I have tried to include items on the site that don't always get full coverage in the newsletter so the two mediums retain some exclusivity. My desire was to provide enough material to the electronic world to get them so interested they couldn't resist subscribing to the newsletter. Apparently it may not have had that effect in the long run.

With that in mind, I will be spending the next several months deciding on a better mix between these two presentation methods. Hopefully, I can come up with a solution that will fit both worlds.

One thing that has been a concept since the web site first went up was to have an electronic version of the newsletter that was controlled for member access only. I will now pursue this option with a new vigor since it will accomplish two goals. First it will make the newsletter available to some members much quicker and with the benefit of color pictures. Secondly, it will allow us to reduce the yearly rate for these members since the cost of providing it electronically is lower than the printing and mailing costs.

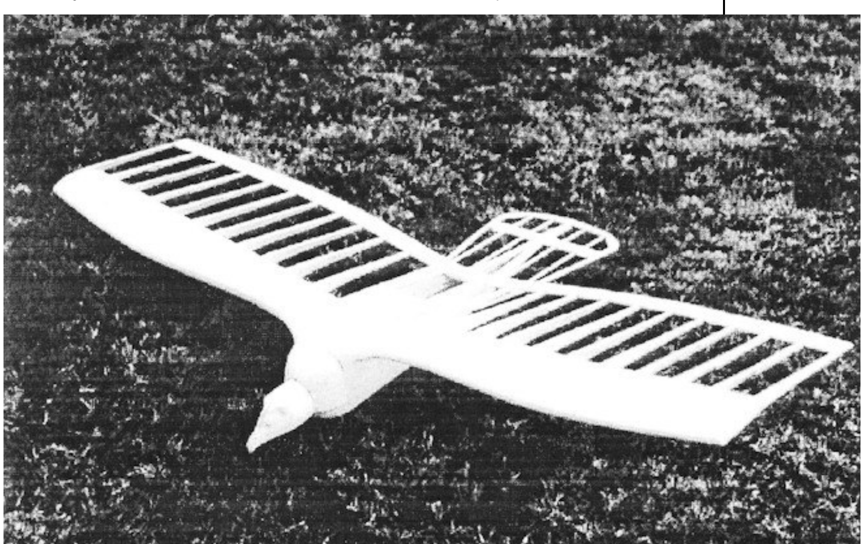
So, stay tuned to see what happens.

Andy

NOVEMBER 20, 1999 PROGRAM

In 1989, after retiring from a 32-year career as a stability and control flight test engineer, Bob decided that we all needed to better understand how birds fly. Not the big challenges like flapping, or vertical takeoffs and landings; just the basic stability and control aspects. This led to the construction of some full-scale, radio-controlled glider models of soaring birds, which, in turn, led to the development of an air-launching technique using another radio controlled mother ship to gather repeatable data on various test configurations. All bird models have been designed as flying wings so that the tail could be freely used in various control schemes.

The first two years were quite productive. Using the Raven as the primary subject, his group quickly solved the puzzle of how birds can fly without vertical tails or rudders. They were also successful at generating turns using tail-tilt as observed on birds which are actually soaring in thermals. (Observation Question: Which way does a soaring bird tilt it's tail; toward the direction he wants to turn, or away from the direction he wants to turn?)



The next few years were completely fruitless as he tried to duplicate the wing-twist method which appears to be used by birds when they are flying faster and not actually soaring. Every wing twist method that he tried, (normal trailing edge ailerons, leading edge flaps, full span ailerons, differential ailerons, etc.) produced higher drag on the up-going wing, which resulted in adverse yaw. He quickly found that the smallest amount of adverse yaw will produce wild nose swings when there is no vertical tail!!! He considered using a fairly large amount of washout in the wing which would place the outer wing panels at zero lift. This would equalize the drag on each wing tip when ailerons were used thus eliminating adverse yaw. He did not try it since any fool can plainly see that the tip feathers

on a Raven are always bent upward, which would not be the case if they were at zero lift. It was only after he began to consider the three-dimensional aspects of the flow around the wing tip and the strong upflow created by the wing tip vortices that he began to catch a glimmer of how the birds MIGHT be accomplishing this feat.

Within the last year he has successfully demonstrated tip ailerons on 3 different bird models that seem to duplicate the roll control observed on large soaring birds. (Design Question: What incidence angle would you expect to set on the forward tip feather of a Raven for best lateral control?)

This is a meeting you won't want to miss. We hope you already have your calendars marked to join us on Saturday. For those of you unable to make it (the SST doesn't service San Diego) we will be video taping Bob's presentation so everyone can share this experience at a reasonable cost.

MINUTES OF THE SEPTEMBER 18, 1999 MEETING (continued)

(ed. - This is the continuation of September's program minutes, where Phil Barnes was telling us about his new math modeling of propeller and their performance.)

For the purpose of calculating profile drag, the calculated or empirical characteristics of the cambered section at its angle of attack are used. Depending on advance ratio and blade angle, significant portions of the blade may be stalled, whereby a section "polar" is of no use. Instead, profile drag coefficient should be characterized with angle of attack, whereby the drag steadily increases with angle of attack beyond stall. In this regime, profile drag can significantly affect torque.

The "vortex step method" is simply a vortex lattice method using only one chordwise horseshoe vortex. The accuracy of this method for predicting the lift of subsonic wings is demonstrated in one of Phil's earlier papers. We have the choice or arranging (N) horseshoe vortices of "vortex step" strength (Γ) side-by-side, or in nesting the same number of vortices of strength ($\Delta\Gamma$), each representing the difference in bound vortex strength between adjacent "vortex steps." Either approach obtains the same answer, but the nested horseshoe vortex has an "incoming" filament, and "bound" filament, and an "outgoing" filament which leaves at the propeller tip (Figure 1.7). Each vortex makes a right turn at its corresponding downwash node located on the chord line of the local equivalent thin section.

At this point Phil went through a lot formulas to demonstrate his approach to the analysis and it is more than what's needed in this forum. So I am going to take some bits and pieces that offer a few of his or other's insights into the analysis. I apologize to Phil if this becomes somewhat disjointed, but you should get a good idea of what was covered and if you have questions just order the paper.

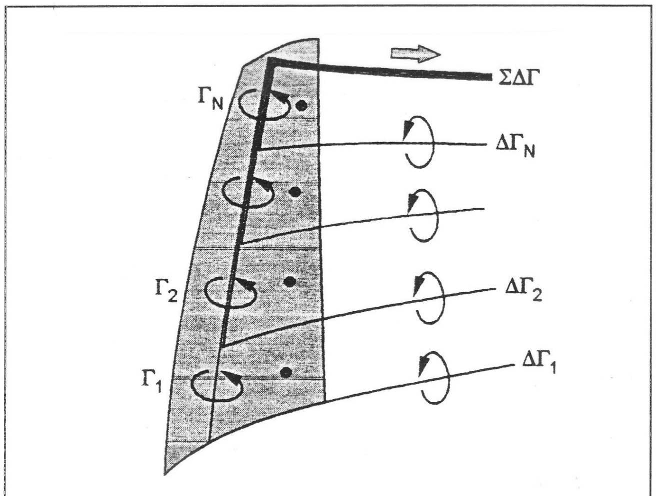
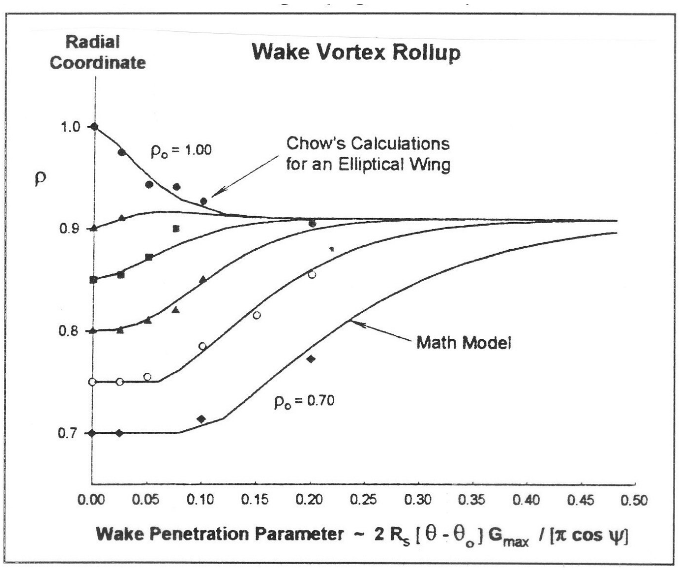


Figure 1.7 Horseshoe Vortices and Downwash Nodes

Wake Rollup Math Model - We know from Prandtl's work that the trailing vortex filaments outboard of the radial position corresponding to the maximum bound vortex strength will rollup into a tip vortex. Chow has computed the rollup of the vortex sheet behind an elliptically-loaded wing. Although he characterized his results in terms of a dimensionless time, we can instead interpret his results in terms of a "rollup parameter" (S) which includes distance and bound vortex strength (Figure 1.11).



Wake-Induced Velocity - Here, we investigate the effects of wake extent and then calculate the wake-induced velocities with three methods. First, Figure 1.13-1 shows the effect of wake extent for three radial stations, using the circumferential averaging method to be described subsequently. For the state advance ratio (0.707), at least one revolution is required to obtain the full effect of the wake.

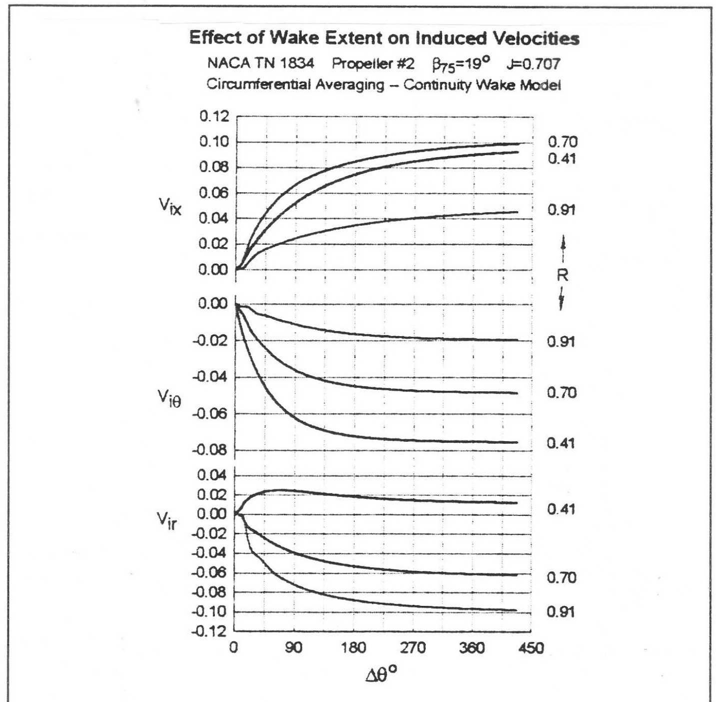


Figure 1.13-1 Effect of Wake Extent on Induced Velocities

Glauert's wake model has two assumptions. The first, rejected by Theodorsen and later by Glauert himself, has each blade section independent of the rest. We will show later that this assumption obtains optimistic thrust. However, we accept and apply the second assumption that the flow is axisymmetric and that the momentum principal, applied to the annular flow through any radial strip (ΔR), allows us to relate (DdT/dR, dQ/dR, V_{ix}, $V_{i\theta}$).

With Glauert's axisymmetric flow model, which is also emulated by our "circumferential averaging" method, the propeller appears to be approaching air as a "bound vortex disk" with only radial variations in *bound* vortex density. Also, the wake appears as a solid streamtube with only radial variations in *trailing* vortex density. This largely reflects Glauert's "many blades" description. As pointed out by Glauert, and as seen on page 4 herein, the flow is irrotational at any point upstream, where the circumferential velocity induced by the wake is canceled by that induced by the "bound vortex disk." Modeling axisymmetric flow is consistent with these phenomena.

Blade Tip Shape - In contrast to a wing, where low Reynolds numbers works against the theoretical advantages of an elliptical wingtip, high Reynolds numbers can prevail near the tip of the propeller. If a propeller planform incorporates somewhat of an elliptical tip, swept or unswept, a working lift coefficient can be preserved at all radii, except perhaps near the hub. Then, the lift and drag (thrust and torque) vanish towards the tip only because the chord vanishes. However, with a constant-chord blade, the obligatory loss of lift and thrust toward the tip is accompanied by non-vanishing drag and torque.

Contemporary blade planforms frequently exhibit a constant-chord region and an "elliptical tip" region. Also, the backbone may incorporate curvature over some or all the blade, as illustrated by the outer portion of the blade for the low-speed propeller shown in Figure 2.2."

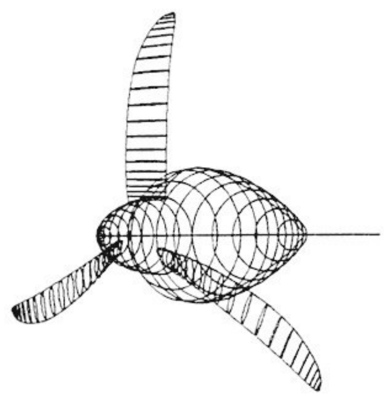


Figure 2.2 Math Modeling Example

Conclusions and Recommendations - A new version of the vortex step method for calculating propeller blade loading was described and verified with NACA test data. Wake models for continuity and rollup were studied. A rationale for math modeling of propeller geometry was presented and illustrated. Then a consistent and compact nomenclature system was proposed and applied for both geometry and aerodynamics. The Betz and Glauert Conditions for optimum loading were shown to be equivalent.

The effect of an axisymmetric body were included in the velocity diagrams and boundary conditions. New wind-tunnel tests should include the measurement of the profile velocity, and this should be included in the calculation of propeller performance. Also, test reports should fully document the blade geometry. Originators of such geometry are of course advised to "math model."

For those interested in obtaining the entire text of Phil's presentation, it can be purchased for $15.00 (US currency) directly from him at:

Philip Barnes
982 W. 11th Street, #5
San Pedro, CA 90731

(A copy of this meetings audio tape is also available from TWITT at a cost of $5.00, postage paid.)

At the completion of Phil's talk, Jack Norris gave the group a quick overview of his current project. He is working on a book that will take all of the complicated math, often referred to by Phil, and convert its results into that understandable in English. This will be meant for pilots that are not mathematicians, but who want to know more about how their propellers work and what they can do to help improve performance through the better use of the correct propeller. It should be ready sometime early next year and he will let us know it has been published and how to get copies, at which time we will pass it along to our members.

OCTOBER COVER

(ed. - Our thanks to Al Backstrom for sending us the material he has on the Stabiloplan shown in 3-view on last month's cover. I have included a little of it here that helps explain more about this aircraft. There were two articles, but it I couldn't find a reference to the publications, and in one case no author was cited.)

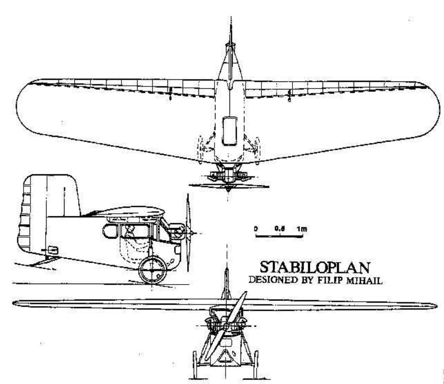
The FILIP MIHAIL STABILOPLAN (1933)
(Author/Publication Unknown)
Light Sport and Soaring Aircraft

"This plane, conceived by Filip Mihail and called by him Stabiloplan because of its stability in flight, was an original construction. Filip Mihail approached the idea of this plane as far back as 1924, when he started a series of studies on various types of aeroplane models.

"The Stabiloplan had no horizontal tail piece, wherefore it was surnamed 'the small tailless plane'. During flight, the pilot could change the position and angle of incidence of the wing.

"After landing, the wings could be folded to the fuselage and the plane could be put into an ordinary garage.

"The Stabiloplan made it first flight on November 22, 1933, taking off from Baneasa Airport with Ion Culluri at the controls. Filip Mihail's plane participated in very many aviation meetings. In June 1934, it made a non-stop flight from Bucharest to Brasov and back to Bucharest, crossing the Carpathian mountains at a height of 3,000 m.



"Ever since 1927 Air Force Captain Constantin Mincu (B.Sc., Eng.) published an article in the review Acronautica, Nos. 11-12, about the prospects of the tests Filip Mihail was carrying out at the time with a view to building his Stabiloplan, in which he wrote:

'In order to simplify the control system and especially in order not to change lateral stability in any way, Filip Mihail uses an autostable profile wing of the kind recently produced by the aerodynamic laboratories; and in order to reach various flying positions he uses a very simple and ingenious device with an endless screw, giving the entire wing the possibility of moving and hence the variation of the angle of incidence. . .'" *(ed. - The rest of the text was missing from this point.)*

STATISTICS

Span	9.00 m
Length	3.70 m
Height	2.00 m
Empty Weight	241 kg
Total Weight	381 kg
Engine	35 hp Scorpion ABC II
Max Speed, Ground	147 km/h
Max Speed, 2,000m	108 km/h
Min Speed	73 km/h
Max Ceiling	4,000 m
Climb	1,000 m in 9 min 25 sec

The STABLE-PLANE
Created by Filip Mihail

by Neculai Moghior and Elena Voicila, museographs

(ed. - These are selected excerpts from this article.)

"On April 4, 1923, he (Mihail) obtained the Invention Patent no. 555924 issued by the French Ministry of Trade and Industry for a monoplane gyro-aircraft, based on the documentation he had submitted on August 19, 1922, in Paris. The monoplane gyro-aircraft was name 'Peace' (La Paix) and its construction was taking over a series of constructive elements found in Vlaicu's and Vuia's planes: the parasol (sun-protected) wing made of a metal frame covered by textiles, the gondola-type cockpit, the landing gear and the transmission system between the engine and the propeller. The elevator rudders were canceled, their role being taken over by the wing sweep modification system in flight; as a flight principle this vehicle was very close to "Vuia 1' which was lacking in elevator rudder and which, in fact, was a real flying wing.

"This vehicle later named 'stable-plane' due to its inflight stability may be included in the so-called 'flying wings' category, the construction of which attracted the interest of many inventors at that time. Concerning the design and construction of certain vehicles of the same type there had already bee attempts made by German, French and English aircraft constructors who had achieved some tailless gliders between 1919-1920.

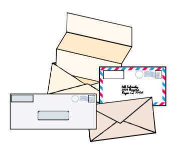
"Although he obtained one of the first patents for a single-engine flight vehicle of 'flying wing' type, Filip Mihail didn't enjoy the support of his time authorities. He had to work hard for 12 years (1923-1935) to see his dream come true due to his own efforts and to some private contributions.

"Based on the aerodynamic calculations performed by Dipl. Eng. Cristea Constantin in a car workshop belonging to an ex-aviation foreman, Ion Peleanu, an improved version of this invention names by Filip Mihail 'Stable-plane' type IV is achieved. The new vehicle is provided with a wing skidding system against the fuselage, modifying thus the pressure center position related to the aeroplane centre of gravity - so, the aeroplane could be vase-lift of in dive. In spite of the indifference showed by the authorities, this aeroplane flew, for the first time, on November 11, 1933, without any publicity.

"Speaking about the first homologation flight, the Dimineata newspaper, dated April 23, 1931 mentioned as follows: 'The vehicle was flying with such an accuracy and easiness which amazed all the people present at the flight. The speed was unbelievable high.'

"In spite of all the successes obtained by the 'Stable-plane' type IV on the occasion of all aviation contests it took part between 1934-35, in the autumn of 1935 the authorities prohibited the flight of this Romanian conception vehicle.

"In 1937 desparated of the authorities hostility, Filip Mihail, although without a pilots license tried to fly with his vehicle. Due to a minor incident because of an air pocket he lost the control of this apparatus which crashed down. After this accident the creator remained with a permanent invalidity."



LETTERS TO THE EDITOR

9/30/99

TWITT:

Please find my check for my subscription renewal. I really look forward to my monthly newsletter. I wish I were closer; I would love to attend a meeting. So many of the people who speak and attend are old acquaintances and friends.

I found a very interesting web site of Captain Chris Good, USAF. It is about his masters thesis, and he has 486 motherboard controlling a fifteen foot span Northrop N-9. He is in Las Vegas, maybe close enough to show his project to the members. The site is:

http://home.earthlink.net/~chrisgood/uav/UAV_Page.html

Thanks and regards,

Michael Riggs

(ed. - First, thanks for the renewal. I don't know how many people read my column each month, but I just went through asking what we could do better to help retain members. We are not sure if it has to do with conflicting activities or whether the amount of information we are including on the web site fills peoples need without becoming members.

Secondly, thanks for the link to Capt. Good's site. It is quite extensive, with lots of pictures and good information on how he is going about his masters project. I will create a link to it from out site to give it wider exposure.)

10/10/99

TWITT:

I would like to join your organization. Enclosed is a check for membership dues.

I was also told someone in California has plans for a wooden flying wing. I would like more information on this. A company in Iowa City has metal wing, but I am not interested in the metal wing.

Richard Ranville
4101 Red Devil Road
Hannibal, MO 63401

(ed. - Thanks for your membership. We hope you enjoy the newsletters over the next year.

As for plans for a wooden flying wing, I will have to presume you are talking about the Mitchell Wing, whose plans are for sale by Richard Avalon. His address is 892 Jenevein Avenue, San Bruno, CA 94066, and e-mail address is mitchellwing@earthlink.net. Sorry, I can't find his phone number at the moment. Good luck.)

10/24/99

TWITT:

My name is Kevin Nowak and I have been a member for a year now and I just wanted to say thanks for taking the time to make the newsletter happen.

I would like to learn how the control system linkage is arranged to make elevons work. Have you ever covered this in a past newsletter, if so, could you please tell me the newsletter number so I could order it. If you have never run a story like this, maybe it would be of interest to others as well as myself.

I also ordered a VHS tape of a presentation with Paul MacCready and, Rudy Opitz and Jim Marske at the flying wing symposium at Harris Hill, but the tape only had the presentation with Paul MacCready. The rest of the tape must have not recorded correctly. However, the part with Pau was great and was worth the price.

Thank you and keep up the good work.

Kevin Nowak

(ed. - Thanks for the kind words on the newsletter. I apologize if the tape didn't have all the part it should have. I can put the additional material on another tape and send it to you if you still would like to have it.

Also, thanks for the question about how to make elevons work. Right off the top of my head I can't think of a particular issue where we show and explain how it all works and have diagrams. I will look through what we have and see if I can come up with anything of value. In the mean time I would ask our members to submit something that would explain how the two motions are mixed between the stick and the elevons.

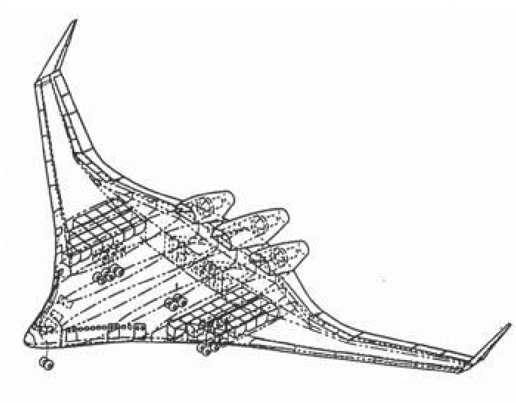
You can also get an idea of how this works by going to your local hobby and finding a mechanical mixer unit for a V-tail or flying wing.)

10/25/99

TWITT:

I work on the Blended Wing Body (BWB) and heard about your web site. Wonderful description. I think that it's a beautiful aircraft.

I'm sure your guys don't have a heck of time, but you might consider putting some of these links on your BWB page. They are from the NASA-Langley wind tunnel testing, some images and NASA's fact page. NASA is in the process of building a "low speed vehicle" (LSV) which is a scaled model of the Boeing BWB. You might watch for stuff leaked out about that in Aviation Week. Stanford's BWB test vehicle and a Boeing press release are also among the links.



Then there is the competitors. Lock-Mart has a military version and Airbus is also working on one, but I haven't seen it on the web yet, only the magazines.

Jennifer Whitlock

(ed. - I didn't put the actual links in the newsletter, but by the time you get this you can find them on the BWB page of TWITT's web site. So if you haven't been there yet, now is a good time for a little browsing.

I asked Jennifer where she is located to see if she might be a source for some other information. She indicated she worked in Long Beach with Blaine Rawdon and Bob Liebeck and would *contact some friends in Seattle, Boeing and NASA to see what she could find on the Kasper designs.)*

10/27/99

TWITT:

I am writing to ask you to please remove the "Ultralight Soaring News" ad from the TWITT Newsletter. The USUSA is non-active at this time and its future as an organization is questionable. I could no longer continue to publish the Ultralight Soaring News due to the many demands for my time from my career and family. Also the inability of the other USUSA leaders to also have adequate time to commit to keeping the USUSA running and viable was a major contributing factor.

I greatly appreciate the support TWITT gave to our organization by regularly publishing the ad for the newsletter and can only hope that someone else may thermal up and give the organization and the newsletter another chance.

Thanks and keep those flying wings soaring.

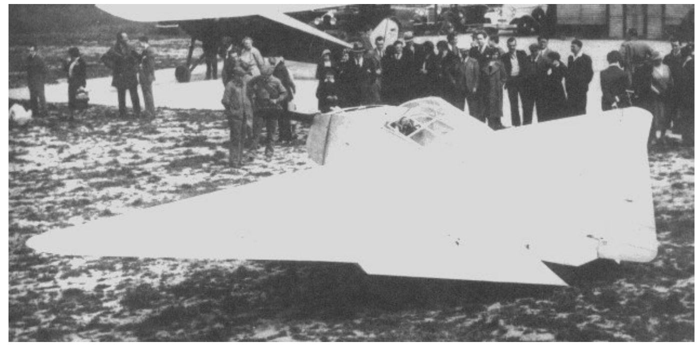
Chuck Rhodes

Former -Editor, Ultralight Soaring News

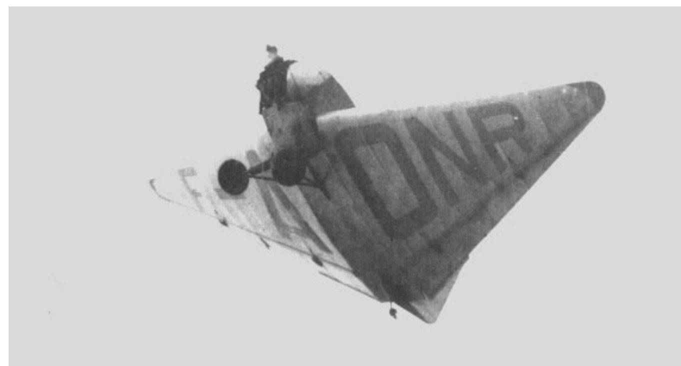
(ed. - Thanks for the note, although I am sorry to hear that your newsletter will no longer be published. Obviously I can sympathize with your plight as to the time it takes to keep something like this going. Fortunately, we continue to have sufficient support with material from various sources to put together a usually meaningful newsletter each month.

I have removed the ad from our classified section, but whenever USUSA get back on its feet and wants to let everyone know, please have a representative contact me.)

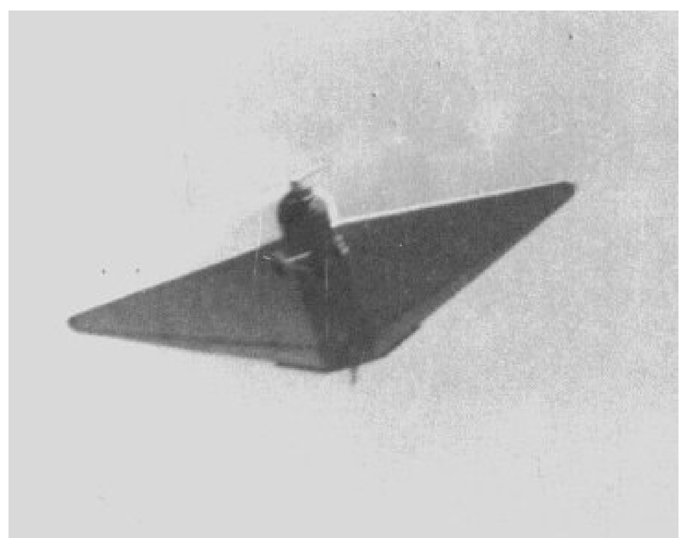
ABOVE: This is an old photo of the Fauvel AV-10 sitting on the ramp at a French airport. Christophe Bordeaux indicated this picture is more interesting than some others since it shows the modified vertical surfaces. Photo source: Unknown.



ABOVE: Another view of the Fauvel AV-10, where you can see the slightly different configuration on the vertical surface.



ABOVE: This is a good air shot of the Fauvel AV-10. You can get an idea of the wing planform and the short moment of the engine in front of the leading edge.



ABOVE: Here is another in-flight shot of the Fauvel AV-10. To see these and other great pictures of the Fauvel flying wings, visit Christophe Bordeaux's web site through the TWITT links page.