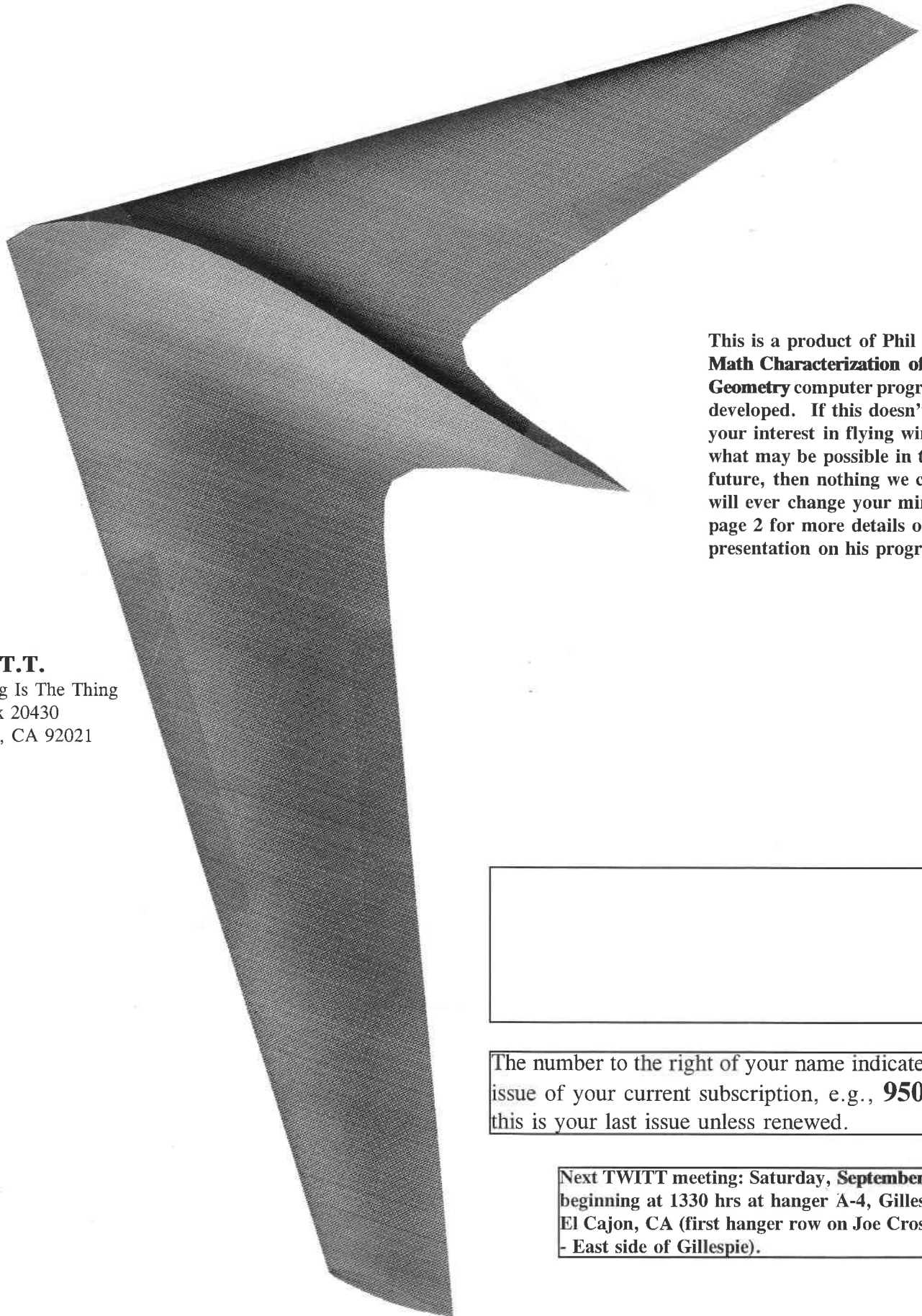


No. 111

SEPTEMBER 1995

T.W.I.T.T. NEWSLETTER



This is a product of Phil Barnes' **Math Characterization of Aircraft Geometry** computer program that he developed. If this doesn't peak your interest in flying wings and what may be possible in the future, then nothing we can do will ever change your mind. See page 2 for more details on Phil's presentation on his program.

T.W.I.T.T.

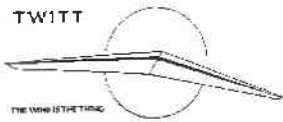
The Wing Is The Thing
P.O. Box 20430
El Cajon, CA 92021



The number to the right of your name indicates the last issue of your current subscription, e.g., **9509** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, **September 16, 1995**, beginning at 1330 hrs at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - East side of Gillespie).

TWITT



**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, did the cover get your attention?? Be sure an come to this month's meeting to find out more about this unique computer program.

I just got back from the Sailplane Homebuilders Association Western Workshop at Tehachapi. There were several TWITT members there soaking up the information from the numerous speakers. However, it was disappointing not to see last year's group of SWIFTS, Mitchells and other tailless hang gliders. There was one new Marske Pioneer IID (completed August '94) belonging to Mike Hostage which flew several times and looked to be doing very well.

This month I took the opportunity to use some of the extra space to include many of the pictures we have taken over the past several months during the meetings. It has been unfortunate that they were not all developed in time to make the issue where they belonged. They should give you an idea of what some of our members look like, especially Bruce Carmichael who has been a constant source of valuable information over the years.

The library bibliography is progressing along at a reasonable pace considering Craig is working full time on a new remotely piloted reconnaissance vehicle. He and Nancy keep coming back to the hanger for more material. I was unable to get in touch with Joel (lost his phone number) to see how well the index is doing, but I expect it is also moving along. I again want to thank all three of our members for taking on these large projects and seeing them through to completion.

I guess I have to make my usual plea for your cards and letters. I hope this month's letters will generate some comments from you, especially those of you interested in computer generated design programs. If you have some experience with them, good or bad, I am sure others would like to hear your opinions so they can make a more informed decision about the purchase of any additional programs.

Thanks, and see some of you at the meeting.

Andy

SEPTEMBER 16, 1995 MEETING PROGRAM

Well, I hope this month's cover has gotten your attention. It was produced by **Phil Barnes** who will be our speaker this month.

Phil has a Master's degree in Engineering Aerosciences and is a lead engineer on the F/A-18E/F program for Northrop Grumman, where he is responsible for propulsion and aircraft performance evaluation. He is preparing an SAE paper with the aid of his home computer on **Math Characterization of Aircraft Geometry** and will preview the material at our meeting.

Those not interested in the math can focus instead on the airfoil design rationale and airfoil/aircraft designs which will be presented. The topics listed below will be covered in a 40 minute viewgraph presentation. Members and visitors present will receive copies of Phil's charts.

- ▶ Integration of airfoil camber to get pitching moment (Cm).
- ▶ Zero-Cm airfoils in soaring birds and tailless aircraft.
- ▶ Math tricks - "varabola," "vellipse," and "varinomials."
- ▶ 2D and 3D math characterization of the geometry of: Wortmann, Eppler, Fauvel, Roncz, Whitcomb, Lissaman, and laminar airfoils; sailplane wing/fuselage planforms and profiles; wing, fuselage and blended designs.
- ▶ Introduction to "SigmaPlot" and "DesignCAD 3D" software for automated 2D/3D drawing and rendering.

Phil has more material on rotation transformation of coordinates and perspective transformation of 2D screen coordinates he can cover depending on how well he gets through all of the above and the desires of the audience. I have warned him to expect questions as he goes along, and I am sure his overheads and slides will peak everyone's interest. This is shaping up to be a very interesting afternoon finding out what a computer can do for the designer and builder.

It also looks like we will have some video tape of the events at the recent International Vintage Sailplane gathering at Harris Hill, NY taken by Bob Fronius who was in attendance.

I know I say it often, but this "is one program you don't want to miss." Don't let a little traffic stop you from getting here this time. Besides you don't want to miss the next spread put on by Chris and Connie Tuffli, our hospitality and refreshment Chairpersons.

LETTERS TO THE EDITOR

7/11/95

TWITT:



Having been a Horten fan for years, I've enjoyed the discussion of the "bell shaped lift distribution" techniques.

I am puzzled at Mr. Uden's finding of higher induced drag in Horten designs.

Reimar Horten was not the only German aircraft designer to use that technique. I fly a Schempp-Hirth Open Cirrus. Their first production fiberglass aircraft, it was the world champion in 1967 and the U.S. champion in 1968. It was the genesis of what is arguably the most successful line of sailplanes flying today. It is unusual in that, while it is an Open Class aircraft with a 17.5 meter span, it has no wing flaps and its rough air speed and its maximum airspeed are the same, 119 kts. While the maximum airspeed of most aircraft is set for strength or flutter limitation, that of the Open Cirrus is aerodynamic. At that speed the tips are neutral and vortex generation and induced drag are at a minimum. It is not meant to be flown above 119 kts. Above that speed, the tips go negative and the L/D ratio goes down as fast as the plane. Can it be that Mr. Uden calculated drag at speeds above the point at which the tips go negative?

The Open Cirrus is a bit of an enigma. While it is a thirty year old design, it is competitive with current 15 meter designs. The only reason I can think of is "bell shaped lift distribution."

Sincerely,

Peter C. King
4200 Loch Highland Parkway
Roswell, GA 30075

(ed. - Thanks for the input on the bell curve. This seems like a never ending discussion, but everyone always learns something from each new perspective.)

6/24/95

TWITT:

I have just received the TWITT newsletter back issues and I'm impressed by the volume of information presented, both historical (my main interest) and technical.

I have been interested in flying wing and tailless aircraft for over ten years, following an article presented in the French magazine LeFanatique de l'Aviation concerning the

Northrop flying wings. Since then I have been gathering information on these strange looking aircraft and I'm pleased to find other flying wing aficionados with TWITT.

I have enclosed to articles from French magazines concerning flying wing studies by the Airbus consortium, some in cooperation with the Russian Institute TSAGI. The articles are:

"Airbus Etudie Un Concept D'Aile Volante", by Serge Brosselin, Air & Cosmos/Aviation International, No. 1518, May 12, 1995, pp. 18-20. (In French)

particular aircraft. (See next page.)

I also sent you copies of photos concerning two American experimental tailless aircraft about which I would like to receive more information from TWITT members. These are:

A low A/R aircraft called MARTIN "Paraplane" designed in 1949 and equipped with a 40 hp Continental engine.

A flying wing inspired from Northrop called SEBRING "Wee Wing" and also designed in 1949.

For Kevin Renshaw, I also have an address and phone number for Rolf Markmann as follows:

Pointstrasse 4, 91233
Speikern, Germany, Tel
91.53.57.89, FAX
91.53.57.90.

Best regards,

Philippe Vigneron
c/o Hotel Sofitel
P.O. Box 7375 P.M.B.15
Jeddah 21462 Saudi Arabia

(ed. - Thanks for all the articles and associated information. Hopefully, some of the Airbus and Aerospatiale pictures will reproduce to give members an idea of what is ahead of us in flying wing technology for large size aircraft. The Katy drawing and a picture should also show them this interesting aircraft. Since the copies of the Paraplane and Wee

Wing were of poor quality, our members will have to go by the names to come up with any information on the who, what and when of these aircraft. I am sure Kevin will appreciate the information on Markmann.

Keep the information coming, even if it is in French. We may be able to get some of it translated at a later date, so don't hesitate, especially if there are pictures and/or diagrams.)

7/15/95

TWITT:

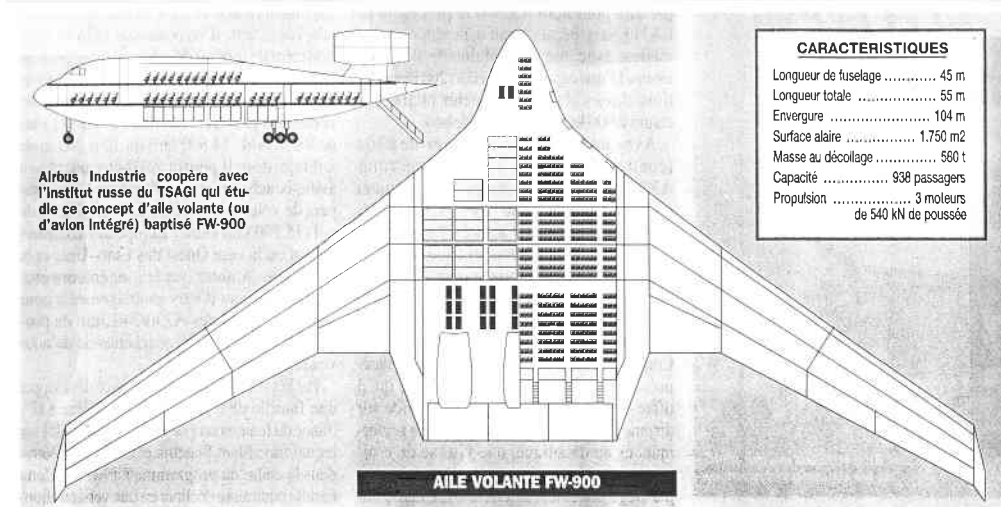
In #109, the book Tailless Aircraft In Theory and Practice (M.R. Plans, England) £35. I would like to know more about the publication before ordering it. Do you have any more information?

By the way, keep up the good work. TWITT has been very helpful.

Thanks,

Fran Joyce
1909 Easton Place
St. Charles, MO 63301

(ed. - From what I recall, we have received several letters from people who have the book. Most seemed to have enjoyed it and found some useful information in the equations and diagrams. It



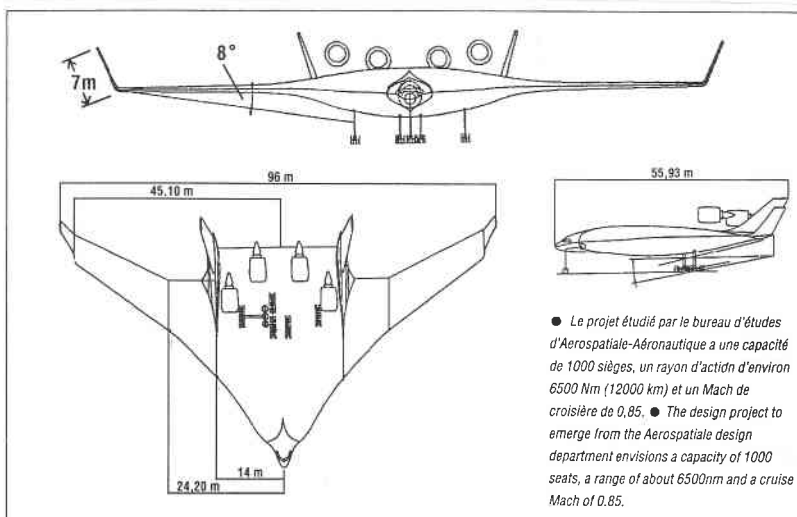
CARACTERISTIQUES	
Longueur de fuselage	45 m
Longueur totale	55 m
Envergure	104 m
Surface alaire	1.750 m ²
Masse au décollage	580 t
Capacité	938 passagers
Propulsion	3 moteurs de 540 kN de poussée

Alrbus Industrie coopère avec l'Institut russe du TSAGI qui étudie ce concept d'aile volante (ou d'avion Intégré) baptisé FW-900

AILE VOLANTE FW-900

Selon les spécialistes, cette formule est la mieux adaptée pour le transport de 900 à 1.000 passagers.

"Studies - Return of the 'Flying Wing' ", Revue Aerospatiale, June 1995. (Bilingual article on a proposed Aerospatiale flying wing transport able to carry 600-1000 passengers. The design shape is very similar to that presented in the Air Cosmos article.)



● Le projet étudié par le bureau d'études d'Aerospatiale-Aéronautique a une capacité de 1000 sièges, un rayon d'action d'environ 6500 Nm (12000 km) et un Mach de croisière de 0,85. ● The design project to emerge from the Aerospatiale design department envisions a capacity of 1000 seats, a range of about 6500nm and a cruise Mach of 0.85.

I have also enclosed a copy of an article presented by Le Fanatique de l'Aviation, September 1992, concerning the PAYEN Pa49 "Katy" along with a personal drawing of this

also seems to me that the book was available through the AIAA if you are a member with the cost being similar by the time you do the British pounds to dollars conversion and add in overseas shipping. If you aren't a member, perhaps you know someone who is that can check it out for you.

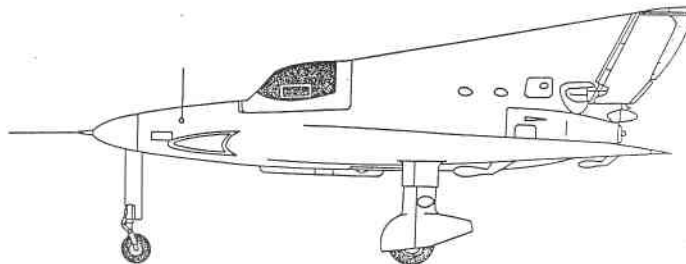
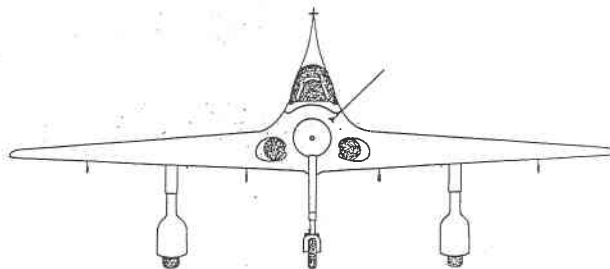
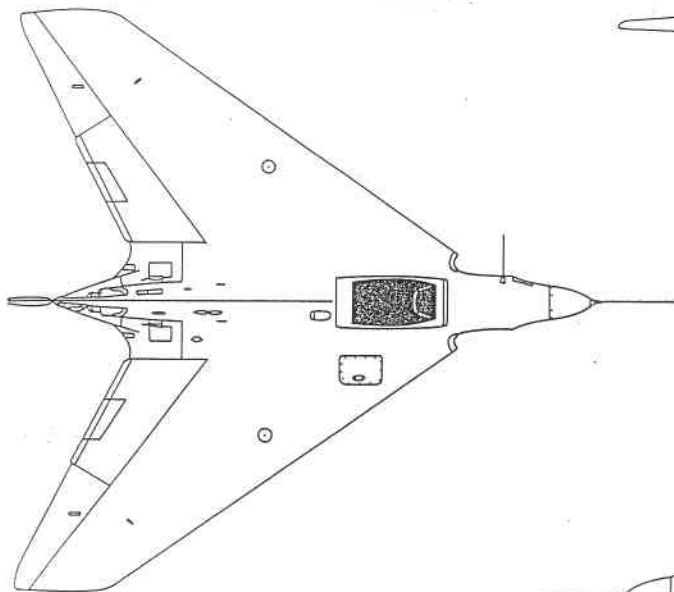
Thanks for the comment on TWITT being very helpful. The basic goal of TWITT is to spread the word on both the old and the new in flying wing/tailess technology from the paraglider to the latest in commercial applications. As you saw from the previous letter we have people who want the historical approach, but we also have those that want to build the most advanced homebuilt flying wing they can.)

the area for about a week, probably in the county park area. Will be keen to see you all there. Will Les King be coming - he's an old co-worker from in D.C. days.

I've given details to Serge Krauss and have offered to set up a card table to sell his bibliography or perhaps he'll be there. We must get at least an evening of unified TWITTERS together for conversations and refreshments. I'll bring this up with Jan Scott as he is now directing much of the NSM activity.

In May 1995 TWITT, Phil Burgers foolishly asked for information on wing in ground effect; so its enclosed. I have another notebook on birds in ground effect and the aerodynamics

94  PAYEN PA 49 "Katy"



7/14/95

TWITT:

Yes! The TWITT package arrived safely. Peter Reidel's three volumes now are on the same pile. I will be talking to Jan Scott to see if I can also present a complete run of Bungee Cord to the Library of Congress. All of this material will be delivered to the Library on my next trip into D.C., probably in August. You will be kept informed as to the status of TWITT into the Library collection.

Now, Harris Hill & the forthcoming Vintage party. Great stuff. I will be there and in

of bird tails (Von Holst, etc.), but it would take time to bring it to the surface. The flight of flying fish continues to be of interest with their tails in the water for propulsion and the tail hydro forces (perhaps) trimming out the quasi-tailless effect of the rest of the system. There's paper out there, too. Please pass the bibliographies on to Phil.

Bill Foshag
 Heishman's Mill
 1206 Creek Road
 Carlisle, PA 17013

(ed. - As a reminder to the members, we sent Bill an full (at that time) of TWITT Newsletters that will be entered into the archives of the Library of Congress. This will make them available to the widest possible audience as aviation enthusiasts scour through the indexes. Our hope is we will attract the interest of some new members who are both seeking more information, but also have their own libraries that could help to enrich all of the members.

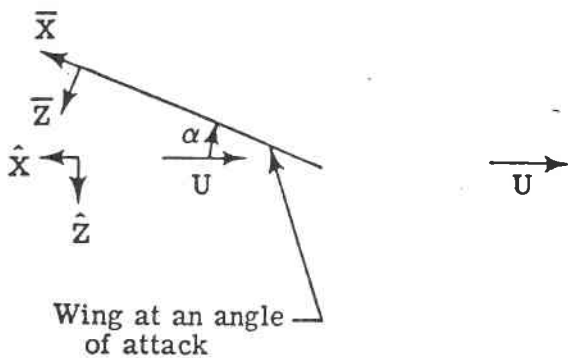
I am sure Philip is thankful for the bibliographies on ground effect publications. This has been a favorite project of his that is now turned into a doctorate's thesis.

By the time this is published the Vintage gathering at Harris Hill will be history, and from what Bob Fronius has said it was quite an event. Lots of old friends found one another after many long years, and the reminiscing about the "good ole days" for the theme of the day. This was probably a once in a lifetime occasion for most vintage sailplane enthusiasts, since the international event is usually held in Europe each year.)

8/16/95

TWITT:

About 18 months ago I purchased a computer program called "VORTEX" from Boswell Co., a vendor in the US. I have installed it in my IBM 386 compatible. I believe thus far that I understand the definitions of all but one small part of the input variables. The vendor being unable to supply me the definition was willing to research one. Nothing of it has as yet come. This variable is "angle of attack" and "local angle of attack". It is with the definition of these variables that I ask your assistance.



I am hoping that someone in or about the TWITT organization will be familiar with the following theory, practice and possibly the program in question and be willing and able to offer me some advice and assistance. I ask you as President and Editor of TWITT to channel my request to the person most suitable and able to help me.

The base program is described in N.A.S.A Technical Note D-6142 titled "Vortex-Lattice Fortran Program for Estimating Subsonic

Aerodynamic Characteristics of Complex Planforms".

It deals with Horseshoe Vortex Lattice where the wing is divided spanwise and chordwise into elemental panels. Each panel has a control point mid span at the 3/4 chord. And to quote the text:

"Part II-Vortex-Strength Computations (p. 14)

This flow constraint is called the 'no flow' condition and is equivalent to requiring that the flow be tangent to the real wing mean-camber surface."

And on p. 16,

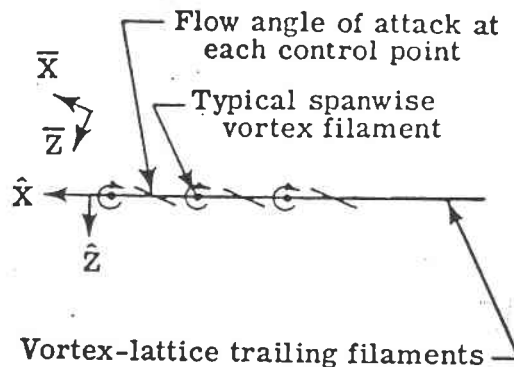
"In the present formulation of a vortex lattice, the angle of attack in equation (5) (below) refers to the flow at the control point for each elemental panel, etc."

$$w \cos \alpha \cos \phi - v \sin \phi - U \sin \alpha \cos \phi = 0$$

In Sketch (d) on page 17 (shown below) are references to "wing at an angle of attack" and "flow angle of attack at each control point".

On page 19 is given an equation (16) (shown at top of page 6) in which:

" α_k describes the local angle of attack in radians at the control point. For the first solution, α_k is that angle of attack due to twist and camber when the root chord angle of attack is zero; for the second solution, the angle of attack α_k is 1 rad for all the control points".



This is about as much as the "manual" gives me to define the input parameter "local angle of attack" as per:

ALP (NV) on page 39 which states:

"Local angles of attack in radians - These are the values at the control point for each horseshoe vortex on the wing when the root-chord angle of attack is 0°. These data will usually require several cards. For the

Equation (16) as noted from page 5.

$$\left[\bar{F}_{w,n,k} - \bar{F}_{v,n,k} \tan \phi_n \right] \left\{ \frac{\Gamma_n}{U} \right\} = 4\pi \left\{ \alpha_k \right\}$$

first value on the first card, use the local angle of attack for the horseshoe vortex nearest the first planform leading edge at the tip; for the second value, use the angle of attack for the horseshoe vortex immediately behind in a chordwise direction. Continue with the rest of the chordwise row of horseshoe vortices at the tip; then continue inboard at the next chordwise row in the same manner to the root until local angles of attack for all the control points have been specified."

I understand the term "root-chord angle of attack". What I don't understand is the A of A of each elemental panel and with reference to what?

My guess is that the definition of "local angle of attack of elemental panel" is that angle which is tangent to the mean camber line at the point in question, i.e. mid span three quarter chord of each panel.

is positive? Or is there a positive direction?

I have sent you a photocopy of the relevant sections of the manual. This may assist the aeronautical computer wonderkind that you enlist in my aid.

And now to stretch the friendship. At about the same time I bought "VORTEX" I also bought a copy of "AIRFOIL-ii" another airfoil design and analysis software. I have had HUGE problems getting it to work properly. I would like to ask the wonderkind if might know the definition of the headings:

BETA GAMMA1 GAMMA2 TAU1 TAU2 DS

which you will find at the head of the columns of numbers in the table entitled "PANEL METHOD 2315" wide carriage paper.

(ed. - The following values were given in the table at point N of 0.

X	=	1.00000
Y	=	.00000
BETA	=	-1.80073
GAMMA1	=	.88906
GAMMA2	=	-.01896
TAU1	=	-.00957
TAU2	=	-1.36165
DS	=	.05124



ABOVE: The "Katy" on display at what I believe is the Salon de l'Aeronautique in 1955 at le Bourget (that's my guess at what the French in the article is saying.)

This leads to the next question. If the aforementioned definition is correct which angular direction is positive and which negative?

For instance, for a normal positive cambered airfoil the tangent to the mean camber panel at the leading edge slopes up to the right. The tangent to the mean camber panel at the trailing edge slopes up to the left. Which

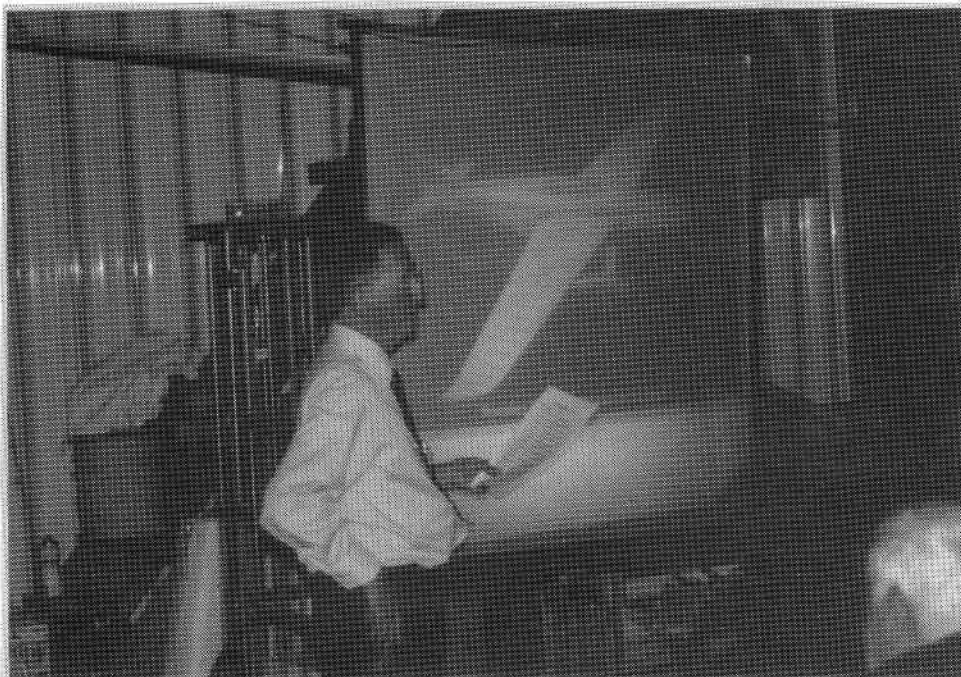
The X axis for N decreases in value until point #17 where it is 0 (zero) at which time it begins increasing to point #34 where it is +1.00. The Y axis fluctuates through positive values until point #17 where it is 0, then fluctuates through negative values until point #34 where it is again 0.

The chart header gives the following values:

CA	=	.11705, 7.21606
ALPHA0	=	.93 degrees
DELTA	=	.00 degrees

Perhaps these will help a technocrat determine what the program is doing without having to see the complete numeric printout.)

I hope some of these (apparent) angles are the "local angles of attack" I enquired about previously.



ABOVE: Bruce Carmichael speaking at the June 1995 meeting explaining the computer generated laminar flow lines on the Nemesis Racer. (Photo by Bob Fronius)

You may contact me at the address below or on:

Private mobile phone: 011 61 018 678 880
 Work phone 011 61 2 642 6003
 FAX 011 61 2 642 6127

I hope you will be kind enough to give me a hand.

Yours sincerely,

Robert Marriott
 P.O. Box 194
 North Strathfield,
 Sydney 2137
 AUSTRALIA

(ed. - Well the challenge is out there to see if one or more of our members can be of help to Robert. I know there are some of you out there that are using computer programs to evaluate you favorite project. If you can't relate to what Robert is talking about, perhaps you could at least refer him to the program you are using if it is satisfying your needs.

This editorial comment should also serve as a note to Philip Burgers (since he is hard to reach via conventional means) to see if me might be willing to share the program he designed if he thought it would help Robert complete his work (without compromising Philip's liability).

I will talk with Phil Barnes about getting a copy of his program

on disk for you. If we get it, we will include it with the package of other material you requested. Also, we have passed on your order for Serge's bibliography and sent him a check for the \$35, so you should receive that item directly from him.

Good luck with you design work. Please let us know if you get any responses and what results you have been able to achieve.)

LIBRARY ADDITION

We received the following article from Frank Gue of Ontario, Canada (who is not a member of TWITT so we don't know how he knows of us) and we thank him for thinking of us and offering the material. The photo copy he sent does not include the name of the magazine or its year, but it appears to be from a Canadian modeling magazine.

"Models Test Your Theories Without Risking Your Neck!", by Frank Gue, B.Sc., MBA, P.Eng., RAA #1204, in two parts, with 6 pages including pictures and 6 references. The article describes various methods

to producing and testing mainly free flight models. There are several areas where the models tested were tailless, some with tip fins and others without.

(If you are interested in a copy send us a couple of bucks for coping, packaging and postage, and we will get it off to you.)

NEW PRODUCT

Bruce Carmichael has just released his new book Personal Aircraft Drag Reduction. This 195 page work starts with a chronological history of experimental verification of large theoretically predicted drag reductions on aircraft components having extensive laminar boundary layers. Unique to this book are data on extensively laminar fuselages obtained in low turbulence wind tunnels, flight and in lakes and the ocean. Practical problems which could limit attainment of these large drag reductions are discussed and methods to minimize them are suggested. The book is limited to aerodynamic considerations, principally on drag reduction.

Bruce's foward also suggests reading Laminar Aircraft Design, Laminar Aircraft Structures and Laminar Aircraft Technology, all by Alex Strojnik, for a clear understanding of boundary layer phenomena, and to obtain detailed design and structural information.

This is a soft cover, bound, 8½ x 11" book

with a great many diagrams, charts and pictures to support the material being presented. It also contains other references of related books and articles for those who want to learn more on this fascinating area.

Bruce has indicated the price for the book is \$25.00 postage paid in the U.S. For overseas shipment you will have to check with Bruce for a quote on the final price.

Send your check or money order to:

Bruce Carmichael
34795 Camino Capistrano
Capistrano Beach, CA 92624

BELOW: As you can see, Bruce packed them into the hanger with his talk on laminar flow. This was one of those times we almost ran out of chairs, but that's the way we like it. (Photo by Bob Fronius.)



AVAILABLE PLANS & REFERENCE MATERIAL



Tailless Aircraft Bibliography

by Serge Krauss

4th Edition: An extensive collection of about 2600 tailless and over 750 related-interest

listings. Over 15 pages of tailless design dates, listing works of over 250 creators of tailless aircraft, and the location of thousands of works and technical drawings for

the Ho 229 (IX), Me 163, & Me 262.

Cost: \$23 (Domestic)
\$32 (European destinations)
\$35 (Asia/Australia destinations)

Order from: Serge Krauss
3114 Edgehill Road
Cleveland Hts., OH 44118

Tailless Tale, by Dr. Ing. Ferdinando Gale'

Consists of 268 pages filled with line drawings, tables and a corresponding English text. It is directed towards modelers, but contains information suitable for amateur full size builders. Price is \$38, postage and handling included (also applies to Canada and Mexico).

You might also want to purchase his new book **Structural Dimensioning of Radioguided Aeromodels**, priced at \$18.00.

On The Wing...the book, by Bill and Bunny Kuhlman (B²) is a compilation of their monthly column that appears in RCSD. Many of the areas have been expanded and it includes coding for several computer programs to determine twist and stability. Priced at US\$28.00.

All these are available from B² Streamlines, P.O. Box 976, Olalla, WA 98359-0976, or (206) 857-7249 after 4pm Pacific Time. Orders shipped elsewhere will be sent surface mail unless an additional \$10 is included to cover air mail postage. Washington residents must add 7.5% sales tax.

VHS VIDEOS AND AUDIO TAPES

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)

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

Cost: \$5.00 (postage paid)
\$6.50 foreign
(postage paid)

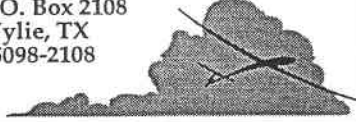
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RIGHT: Don Downing, of the then General Dynamics Engineering Models Dept., getting his B-2 and A-12 models out of the van in preparation for flight.

BELOW: Don making the final adjustments to the B-2 engine just prior to start-up.

BELOW RIGHT (two shots): The B-2 in flight. The lower one is getting to the point of almost being stealth. (Photos were contributed by Kevin Renshaw some time ago, but got lost in the archives for a while.)

