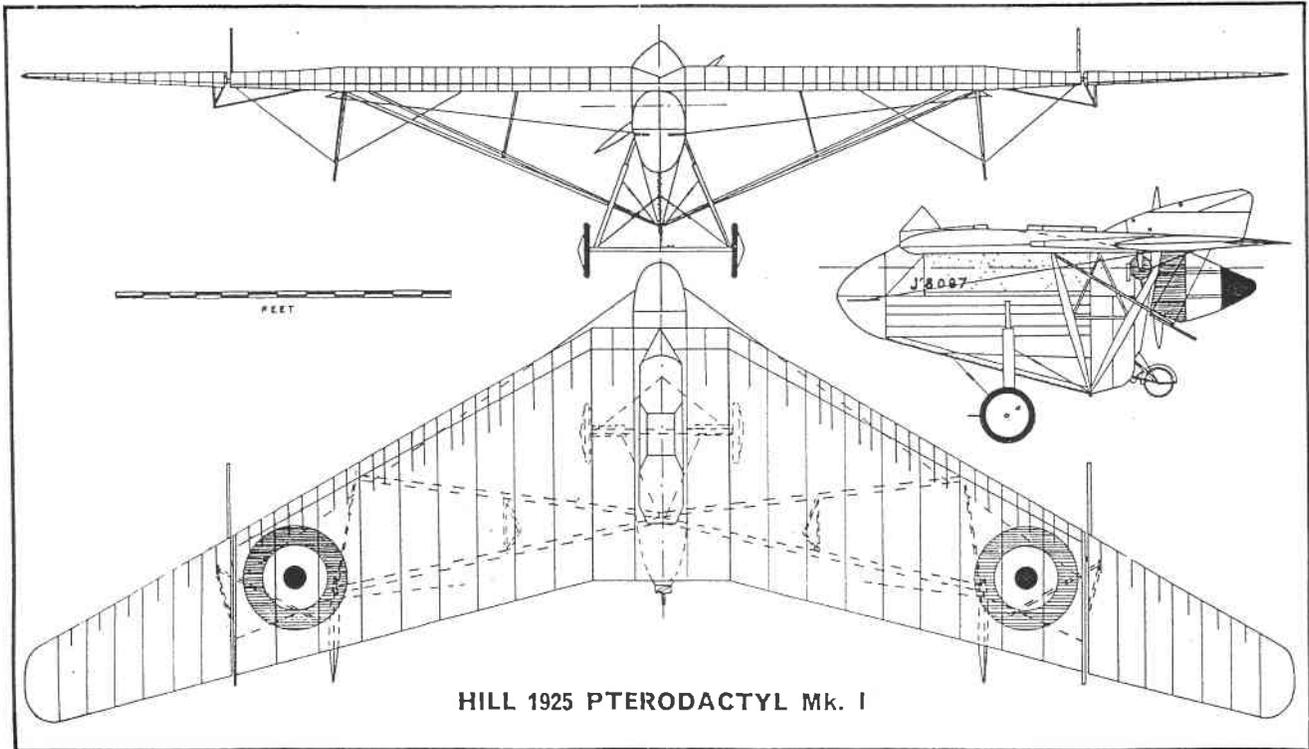


T.W.I.T.T. NEWSLETTER



HILL 1925 PTERODACTYL Mk. I

From an article of unknown origin on Pterodactyls (contributor also unknown/lost). It was powered by a 33 hp horizontally opposed, twin-cylinder, air-cooled Bristol-Cherub.

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., **9205** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, May 16, 1992
 beginning at 1330 hrs at hanger A-4, Gillespie
 Field, El Cajon, Calif. (First hanger row on Joe
 Crosson Drive - East side of Gillespie.)

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

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

T.W.I.T.T. Officers:

President, Andy Kecskes (619) 589-1898
 Vice Pres., Dave Pio (619) 789-1650
 Secretary, Phillip Burgers (619) 563-5465
 Treasurer, Bob Fronius (619) 224-1497

Editor (Acting), Andy Kecskes

The **T.W.I.T.T.** office is located at Hanger A-4, Gillespie Field, El Cajon, California.

Mailing address: P.O. Box 20430
 El Cajon, CA 92021
 (619) 224-1497

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Meetings are held on the third Saturday of each month, 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

Although Dr. Katz was unable to make last month's meeting, the group enjoyed a fine presentation by our own Philip Burgers. I want to thank Phillip for doing an excellent job and filling in at the last minute.

The last two pages of this month's newsletter have a recap of all the logo submissions we have received over the past year or so. We would like you to circle the logo of your choice, tear off this section of the newsletter, fold it in half so the return address is showing, place a stamp on it, and finally, mail it back to us. We will allow two months for the returns to reach us (that's for you procrastinators out there), and then publish the results in the July 1992 newsletter.

Once the logo is decided on, we can then move forward in determining whether to have cloth patches, decals, etc., made up. This will depend on the membership's response to the competition and other correspondence we receive indicating your desires. If you have an opinion, please let us know.

As promised, the financial statements are also in this newsletter. These are for 12/31/92, and there have been substantial gains since that time in both membership and financial resources. There have been some very nice donations by several members, and we want to thank them for their generosity. This gives us some breathing room for buying supplies and looking into better ways to serve the membership.

That's all for now.

Andy

MAY PROGRAM

Our featured speaker for this month will be Dr. Joe Katz, Professor of Aerodynamics at San Diego State University. Dr. Katz was unable to make the April meeting, but will take this opportunity to discuss computational fluid dynamics. Phillip got us started last month with the kind of program Dr. Katz inspired him to begin working on, much to everyone's benefit. I am sure this will be an interesting program for all.

Julio Paredes, one of our newest members, will be bringing his MiniBat flying wing to the meeting and setting it up for all to see and comment on.

Phillip has been working hard to put together another good program for the June meeting, so keep watching this space for details, and plan on coming. We are hoping to keep your attention over the summer months with meaningful programs. Let us know how we are doing.

MINUTES OF THE
APRIL 18, 1992 MEETING



Andy opened the meeting with the announcement the Dr. Katz was unable to make it this month, but has been confirmed for May. In lieu of Dr. Katz, Phillip Burgers will be discussing the

capabilities of his dynamic forecasting program based on information he got through Dr. Katz during an academic class.

The raffle prizes were to be a digital clock timer donated by Pete Thompson of AeroTech, an aircraft supply store at Gillespie Field. This is one of many things AeroTech has donated over the years. A second prize was also to be awarded, and it was the book The Horten Flying Wing in World War II, by H.P. Dabrowski.

One of the visitors was Julio Paredes, who had been referred to us by the local EAA chapter since he wanted to find out more about flying the MiniBat. He is currently putting one back into flying condition and wants to talk with people who have had actual flight experiences. He has offered to bring the MiniBat to next month's meeting, and we quickly took him up on the offer.

Reg Finch, an ex-TWITTer and active EAA member, took the floor to put in a plug for The San Diego Flight Museum. The organization is designed to put together a fleet of

airplanes that can be taken to various airshows, as well as be on display at their Brown Field hanger.

They are having an open house at their hanger near Victory Aviation. This is also meant to be a fund raiser with donations of \$4 for adults and \$2 for students (payment is optional). You are welcome to fly-in since the FBO (Victory) is also having an open house since it is a new operation.

The doors open at 1:30, and the featured speaker at 2:30 will be Dave Ferguson, Director of Flight for the Lockheed Skunk Works. He will be talking about the F-22 Advanced Tactical Fighter (*ed. note: the one that just recently hit the deck on a test flight and was destroyed*). At 3:30 Doug Pilling of Easton Composites will be talking about advanced composites.

The museum currently has a Gnat Jet Trainer, a Long Eze, and an L-2 replica. They are looking for more airplanes as funds and time permit. They are also open from 10:00 to 4:30 every Saturday and you are encouraged to stop by.

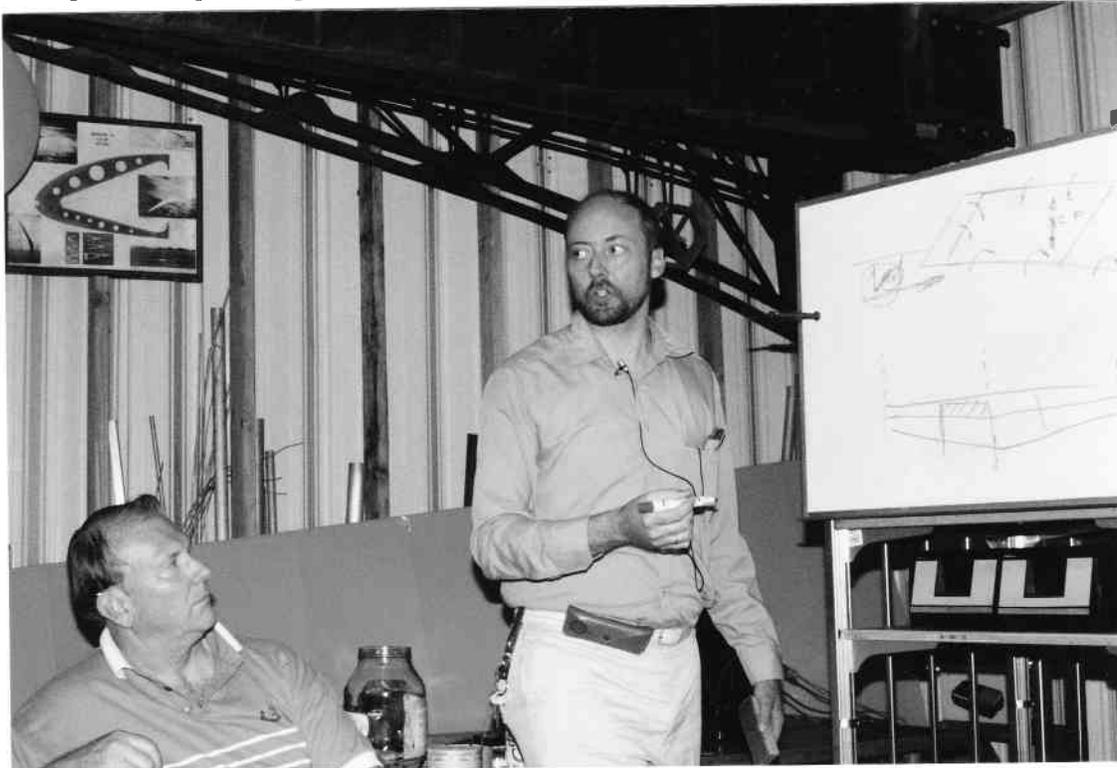
Andy commented that May was an active month since there also was going to be the Sailplane Homebuilders and Vintage Sailplane Associations annual get together at Hemet Field on May 23-25. This year the competition for best WWII glider in original paint schemes should be interesting since Doug Fronius should have the LK completed. Last year a TG-2 won.

Phillip took the floor to thrill us with an explanation of what his computer program

can do to predict wing design. He started by saying the talk was a tribute to TWITT as a way of saying thanks for its support over the years.

After Dr. Katz's talk at TWITT about 3 years ago, Phillip became interested in computational fluid dynamics (CFD) and audited his classes on low speed aerodynamics. He learned so much that he went home to his computer and started writing a program to test Dr. Katz's statements. Phillip's program

is designed to model or simulate a wing's performance with reasonably accurate results. Philip began with a basic explanation of



Phil Burgers (standing) diagraming horseshoe vectors, watched closely by Andy Kecskes.

why wings fly to form the basis of how the program goes about analyzing the wing's flow. This process starts with thinking of a wing as a rotating cylinder that creates certain flow lines and pressure differentials. These vortexes can be described in a mathematical way which enables the computer to work with the data.

The wing is divided into separate panels. A horseshoe vortex is located for each of these panels and a control point established for the vortex's velocity. For a given velocity and angle of attack of the wing, a velocity component is produced through the control point. The program is asked to compute the strength of the horseshoe vortexes that will exactly offset the strength of the component through the control point. The constraint is that air cannot actually flow through the wing.

After several years of writing program code in Turbo BASIC he was getting encouraging results.

Phillip went through a series of view graphs that showed how effective this vortex panel method is in achieving accurate results. He was able to duplicate information produced by NASA for the same airfoil design and swept-back configuration.

The program asks for whether you want to study a flying wing, conventional configuration, or a canard. Then you have to decide on taper, linear taper, or non-linear dihedral, this latter choice giving him the capability to study winglets.

Program input includes dihedral, twist (aerodynamic or geometric), linear and non-linear values, airfoil coordinates, and many other parameters. Philip skipped over the six or so pages of input data he used for his test runs.

One question came up about boundary layer affects on the program, and Philip responded by saying there is a big limitation due to the use of inviscid flow. This doesn't hurt his program too much, since air acts as inviscid when it is above the boundary layer. Its okay as long as he does not try to produce high angle of attack stalls which brings the boundary layer into play.

There was some discussion about the affects of airfoil thickness on the lift slope and distribution of a wing and how that would affect the outcome of the program's results.

At this point in time the program only considers the wing and tail planforms. In the future he will try to develop the necessary coding for the fuselage.

The question has been asked whether CFD programs can replace wind tunnel testing. According to Phillip, they are not there yet, but with more testing and comparing of data, programs can be refined to provide results equal to that of a tunnel.

So far Phillip is satisfied with what the program is doing for him. He plans on proceeding with more capabilities as time permits. He has mentioned in the past that if anyone is interested in running their wing

thorough his program, they need to contact him directly. After discussing what is expected of the results and what the use of the information will be, he will decide on whether the program should be used (liability factors and all that, you know).

Phillip closed his talk by saying this is just the beginning of what Dr. Katz will be covering in more detail next month.

Upon the end of Phillip's presentation, the raffle prizes were awarded. Bob Chase won the digital timer which should be perfect for his new ultra-light, and Mark Motley won the Horten book (sorry Phillip).

FINANCIAL DATA

BALANCE SHEET (12/31/91)

Current Assets	
Cash	610.49
Accts. Recvble.	60.00
Inventory	<u>160.35</u>
Total Current Assets	830.84
Fixed Assets	
Material & Equip.	1,648.75
TOTAL ASSETS	<u>2,479.59</u>
Liabilities & Equity	
TOTAL LIABILITIES	<u>2,479.59</u>
& EQUITY	<u>2,479.59</u>

INCOME STATEMENT (12/31/91)

Membership Dues	886.79
Raffle Tickets	62.00
Back Issues	77.00
Information Packs	20.00
Donations	12.25
Miscellaneous	<u>42.90</u>
TOTAL INCOME	1,100.94
Less:	
Newsletter Expense	425.87
Mailing Expense	330.10
Raffle Expense	57.97
Miscellaneous Expense	<u>123.23</u>
TOTAL EXPENSES	<u>(937.17)</u>
NET INCOME (LOSS)	<u>163.77</u>

LETTERS TO THE EDITOR

4/7/92

TWITT

Thank you again for locating and sending the plans. Thanks also for sending my first issue of TWITT. It is obvious from our phone



conversations, and from the newsletter articles, that the members of TWITT include the spectrum of aviation enthusiasts.

I recently saw a quote that reminded me of why designers continue to return to the flying wing

concept:

'In anything at all, perfection is finally attained not when there is no longer anything to add, but when there is no longer anything to take away...'

-Antoine De Saint Exupery, Wind, Sand and Stars

Bob, I have enclosed two items that you can add to your library. First, an article from AOPA Pilot (May 1981) entitled, "The World According to Kasper." Second, a photo copy of a paper airplane flying wing B-2 bomber.

I hope that as a member of TWITT I can contribute to its success, and the enjoyment of its members.

Again, thank you,

Sincerely,

Bill Spencer

(Ed. Note: Thank you Bill for the two items. The article is a little long for a newsletter item so we will add it to the library as you suggested. When time permits, I will enhance the lines on several of the pages on the B-2 paper plane and use it as filler in the newsletter so others can have some fun.)

4/6/92

TWITT

After several years of publishing model aircraft plans, B² Streamlines has expanded its horizons by entering the book publishing field. We are pleased to announce availability of our first effort, Tailless Tale, by Dr. Ing. Ferdinando Gale'.

Dr. Ing. Gale', a TWITT member and retired aerodynamics engineer, resides in Italy but is still active as an international consultant to major aircraft firms. His first love is RC sailplanes, and he has previously authored a book entitled Aerodynamic Design of Radioquidged Sailplanes. This work, a dual language publication, was very well received by the modeling community, and nearly 1000 copies sold in the U.S. alone.

Dr. Ing. Gale' has been accumulating information on the aerodynamics, design, and construction of tailless model aircraft for many years. The publication of Tailless Tales marks the fruition of over a year of writing, editing and drawing.

Tailless Tale consists of 268 pages filled with line drawings, tables, and a corresponding

English text. This book is directed to modelers, whether they be interested in RC, free flight, or control line flying. It serves both as a general guide for those modelers intrigued by the history and potential of tailless aircraft, and as a source of technical information for those designing their own models. As many TWITT members are amateur builders of full sized tailless 'craft, it should be noted there is much information presented which is also applicable to their endeavors.

Tailless Tale may be purchased directly from the publisher, B² Streamlines, P.O. Box 976, Olalla, WA 98359-0976. Cost is \$33.00, postage and handling included, until June 30, 1992. For orders postmarked July 1, 1992 and later, the cost will be \$38.00, postage and handling included. These prices also apply to orders sent to Canada and Mexico. Orders to be shipped elsewhere will be sent by surface mail unless an additional \$10.00 is included to cover airmail postage. Washington residents must add 7.5% state sales tax.

We would very much appreciate publication of the above information in the TWITT newsletter as time and space permit. Should you have any questions regarding the publication of Tailless Tale please feel free to contact us at the above address or at (206) 857-7249 after 4pm Pacific time.

Sincerely,

B²

(Bill & Bunny Kuhlman)

(Ed. Note: As you can see we were pleased to publish your news. Jim Gray stated the following in his review of the book in the April 1992 edition of RC Soaring Digest: Tailless Tale provides a super "read" but won't be the kind of book you'll whip through in an evening or two while waiting for your favorite TV program. Instead, it will more likely be the book you sit down with for serious study. However, if you're a "browser" like me, then you'll do a lot of skipping here and there to find subject matter to come back to later."

We hope you are successful in distributing this book to the TWITT and RC modeler community. I know Bob has already said he has to have one, so that's a start.)

3/18/92

TWITT

Thank you for posting me TWITT newsletters, history/summary sheet, "When Dreams Take Wing" AIRSPACE Apr/May '88, Lindbergh's order for his 1927 Ryan monoplane, and membership information.

Please find my membership application enclosed. I want to be a TWITT to improve my knowledge of things that fly in the wind, but I am not able to help much as I am in the learning mode. I am interested in the application of aeronautical theory and fluid

mechanics to parachutes, hang gliders, paragliders, ultralights, model aircraft RC sailplanes and cliff soarers, wind surfers, kites of all kinds, and the design and construction of tailless and all wing airplanes (particularly models), and bird and bat flight.

Could you advise on the cost of Don Mitchell's tapes if still available (including postage)? I am interested in the ASW-24 model hang glider - have you details in TWITT newsletter or otherwise.

Thanking you,
Bob Peirson
13 Park Avenue
Chatswood
NSW 2067 Australia

(Ed. Note: Welcome to TWITT Bob. I am told all the items you ordered have been sent out already, so you should be getting them very soon. As for the Mitchell tapes, \$6.00 US should cover the cost of tapes and postage to Australia. This would be the ones for the March 1992 meeting, but if you would like to hear what he had to say at the Sept. 1991 Tehachapi workshop you can send \$8.00 US for the total package.

It sounds as if you have a wide range of interests in the world of aviation and modeling. I am sure there are other members out there with similar interest, and perhaps you might hear from one of them about a particular subject.

We hope you enjoy TWITT.)

4/13/92

TWITT

Enclosed are my dues for 1992. I am enjoying my membership in TWITT and just want to tell you that the Summit Aircraft address is inoperative.

I wrote to that address a couple of years ago and had my letter returned. After I read about your receiving a flyer from them, I got a telephone number (1-817-565-1652) and called it. The guy who answered said the address is a greeting card outfit and he gets lots of calls for Summit AC and he doesn't know where they are. Maybe one of the TWITT members might know where the Trident is. I saw it in Santa Paula way back in 1985 and I was impressed by the concept.

Good luck.

Cordially,
Jim Loyd

(Ed. Note: Thanks for the information. A closer look at the brochure that someone gave us shows a copyright date of 1984, so perhaps the whole thing is dated. The phone number on it is (817) 566-0060, but we can't say if it is any better than the one you tried. It is a shame that it is not a current project since it looks quite interesting.)

ODDS AND ENDS

Karl Sanders sent us an artist's very conceptual drawing of a flying wing civil aircraft based on the 1989 Airbus Industrie integrated airliner design. This is from *Flight International*, 1-7 April 1992, p. 27.

He also sent us a copy of the *Journal of the Aeronautical Sciences*, August 1949, article entitled "Spanwise Lift Distribution for Sweptback Wings." We have included this drawing below.

Karl also sent us the following addresses and telephone numbers that can be used for ordering technical papers and reports.

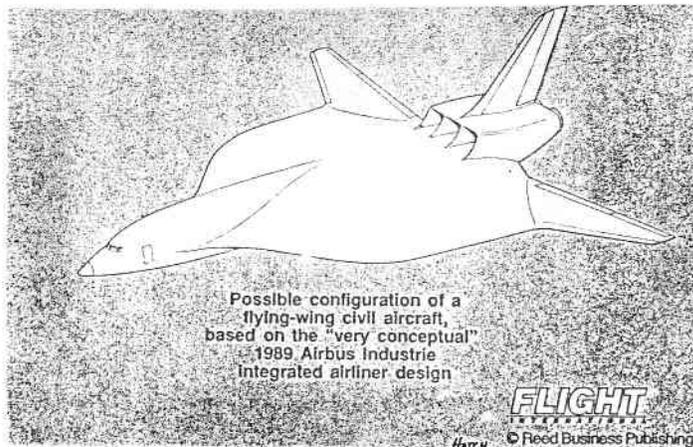
For government related reports contact:

N.T.I.S.
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4660

Magazine articles and books from:

A.I.A.A. Technical Information Svcs.
555 W. 57th Street
New York, NY 10019
(212) 247-6510

We would like to thank Karl for these and other valuable contributions and comments over the past several years.



We and several of our members noticed the recent article in the March 1992 issue of *Popular Science* on the SWIFT (Swept Wing with Inboard Flap for Trim) flying wing hang glider. This looks like an exciting project that is going well. The photo included here was taken at Torrey Pines on April 18 by Floyd Fronius, while the rest of us were faithfully at our TWITT meeting. We didn't find out until later that the SWIFT was in town and flying, or we could have moved the meeting to the cliffs.

We also have another article in the library on the SWIFT entitled "Development of the SWIFT - A Tailless Foot-Launched Sailplane," published in the January 1991 issue of *Hang Gliding*.



SWIFT awaiting flight at Torrey Pines
(Photo by Floyd Fronius)

Gene Sandburg sent along a copy of "Gemini Update - A Two Place Flying Wing for your Christmas Stocking?," published in the October 1987 issue of Plane and Pilot.

He also included a short article taken from Modern Aircraft, by Major Victor W. Page, Air Corps Reserve, USA, published by The Norman W. Henley Publishing Co., 1928. The article covers a "Wing With Fixed Center of Pressure" and talks about Capt. G.T.R. Hill's Pterodactyl airplane with a swept back wing and no tail.

Both of these items have been added to the library.

INFORMATION NEEDED

Bob Fronius, TWITT's Founder, along with some other early aviation pioneers in the San Diego area, are trying to get a National Monument established on the soaring sites at Point Loma. He is looking for information and/or pictures of flight activity from the Point Loma area during the period of 1929-30, including any flights of Hawley Bowlus. If you don't have pictures, but were an eye witness and could provide some detailed accounts of the soaring, that would be great. If you can help, contact Bob at home in the evenings, the hanger during the day, or through the TWITT post office box. Thanks for your help.

AVAILABLE PLANS & REFERENCE MATERIAL



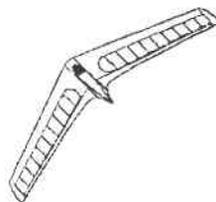
Tailless Aircraft Bibliography
by Serge Krauss
Cost: \$20
Order from: Serge Krauss
3114 Edgehill Road
Cleveland Hts., OH 44118

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Info packs \$8 each, or \$15 for both.

Marske Aircraft Corp.
130 Crestwood Drive
Michigan City, IN 46360

MODEL WINGS



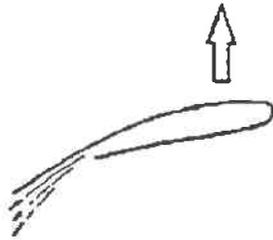
The cover of the July 1991 issue of RCModeler features a flying wing called the "Stealthbat" offered by Wing Manufacturer. There was no price listed, but they can be contacted at:

306 E. Simmons
Galesburg IL 61401
(309) 342-3009
Catalog: \$4.00

Omni Models carries the Future Flight Klingberg

Wing kit for \$39.99 (item #FTF4000). They can be contacted at:

P.O. Box 1601
 Bloomington IL 61702
 1-800-747-6664 or (309) 663-5798
 Shipping: \$5.00



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For those of you who would be interested in assisting Budd Love with some aspect of his High Internal Air Mass (HIAM) project, he would be glad to hear from you. This concept has great potential for the future of air transportation.

Contact: AIRLOVE, LTD.
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 La Jolla CA 92037
 (619) 459-1489

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BRIEF REPORTS of investigations in the aeronautical sciences and discussions of papers published in the JOURNAL will be presented in this special department. The publication will be completed 6 to 8 weeks after receipt of the material. No proof will be sent to the authors. The Editorial Committee does not hold itself responsible for the opinions expressed by the correspondents. Contributions should not exceed 800 words in length.

Spanwise Lift Distribution for Sweptback Wings

Alan Pope and William R. Haney, Jr.
 Georgia Institute of Technology, Atlanta, Ga.
 April 15, 1949

THE METHOD OF Schrenk¹ for obtaining the spanwise load distribution of an unswept wing has been discussed and extended by Flatt,² who (a) advanced a procedure for accounting for twist and flaps and (b) noted that the Schrenk-Flatt method required approximately 5 per cent of the time needed by other methods. From a limited number of calculations, the authors of this letter concur with Flatt.

However, Schrenk and Flatt did not consider sweptback wings. The methods of Weissinger³ and Theilheimer⁴ are frequently used for this problem but are somewhat lengthy. The following formula, which assumes that the effect of sweepback on the non-dimensional span loading curve is linear, appears to give results closely approximating experiment while requiring only a minimum of time, a many-point span loading curve being obtainable in about 1 1/2 hours.

The method is as follows:

(1) Find the nondimensional spanwise lift distribution for zero sweep $(cc_l/\bar{c}C_L)_\Lambda = 0$ according to Flatt-Schrenk. (c = local chord, c_l = local lift coefficient, \bar{c} = average chord, and C_L = wing lift coefficient, Λ = angle of sweepback at quarter chord.) For an untwisted wing of constant airfoil section, $(cc_l/\bar{c}C_L)_\Lambda = 0$ is simply the mean between the geometric chord and a half-ellipse having the same area and the same major axis as the wing.

(2) Reduce it locally according to the relation

$$\left(\frac{cc_l}{\bar{c}C_L}\right)_\Lambda = \left(\frac{cc_l}{\bar{c}C_L}\right)_{\Lambda=0} - \left(1 - \frac{2y}{b}\right) [2(1 - \cos \Lambda)] \quad (1)$$

where y = local span station, ft.; and b = wing span, ft.

Eq. (1) is demonstrated in Fig. 1, where it is seen that the second term represents a triangular loading diminution that is largest inboard. Subtraction of this loading from the unswept loading yields a new wing C_L which may be found by integrating the curve. Thus

$$C_{L\Lambda} = \int_0^{1.0} cc_l/\bar{c}C_{L\Lambda} d\eta \quad (2)$$

where η = nondimensional span station $2y/b$.

(3) To obtain values for other lift coefficients, increase or decrease the unswept nondimensional loading by multiplying it by the desired amount. Then correct as before to obtain the loading with sweep.

Four comparisons of this method with others and experiments are given in the drawings. The following comments are pertinent:

Fig. 2. A.R. = 4.66, 31° sweep, taper ratio 2.26 to 1. The method of Eq. (1) closely follows both experiment and Weissinger. At the tip it is slightly closer to experiment than Weissinger.

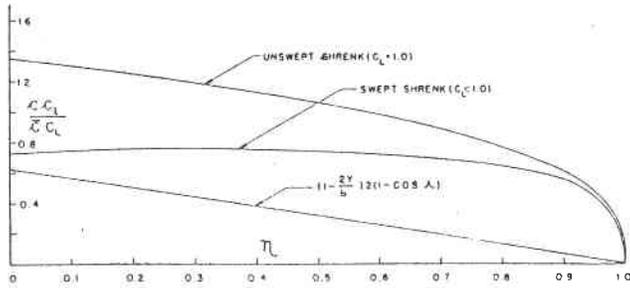


FIG. 1.

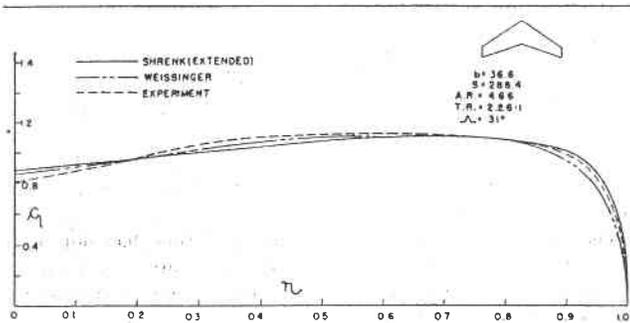


FIG. 2. Spanwise distribution of section lift coefficient.

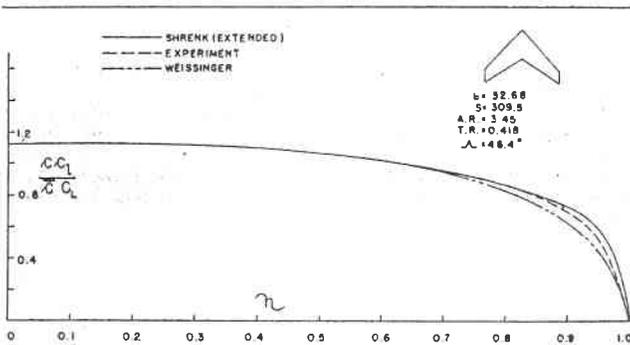


FIG. 3. Spanwise load distribution.

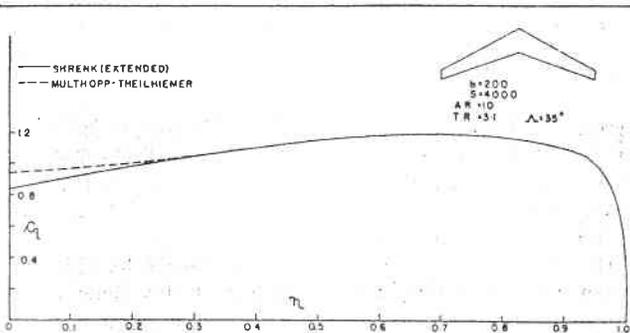


FIG. 4. Spanwise distribution of section lift coefficient.

Fig. 3. A.R. = 3.45, 46.4° sweep, taper ratio 2.4 to 1. Excellent agreement of the method of Eq. (1) with Weissinger and experiment is noted over the inboard 70 per cent span. Over the outboard portion, the method of Eq. (1) is slightly closer to experiment than Weissinger.

Fig. 4. A.R. = 10, 35° sweep, taper ratio 3:1. The method of Eq. (1) compares well except at the root, where the method

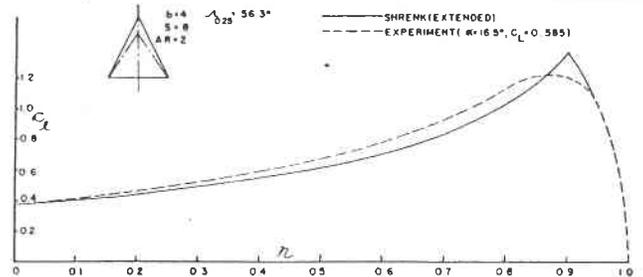


FIG. 5. Spanwise distribution of section lift coefficient.

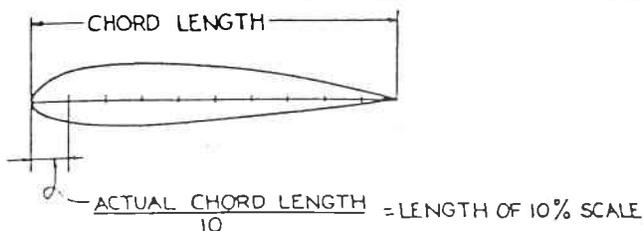
of Theilheimer rises asymptotically and must be faired. No experimental data are available.

Fig. 5. Delta wing, A.R. = 2, 56.3° sweep. Good agreement with experiment at all points out to 90 per cent span at low values of C_L . Agreement is actually better than the figure might indicate, because the Schrenk (extended) curve should be raised slightly to give the same value of C_L as the experimental curve. The Schrenk curve is faired to zero from the 90 per cent span station.

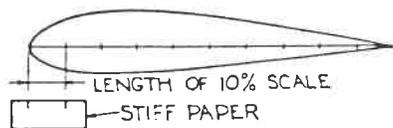
The authors wish to note that sufficient time has not been available to make complete calculations at many aspect ratios, taper ratios, and twists; hence, Eq. (1) must be used with caution. The authors would welcome comments.

REFERENCES

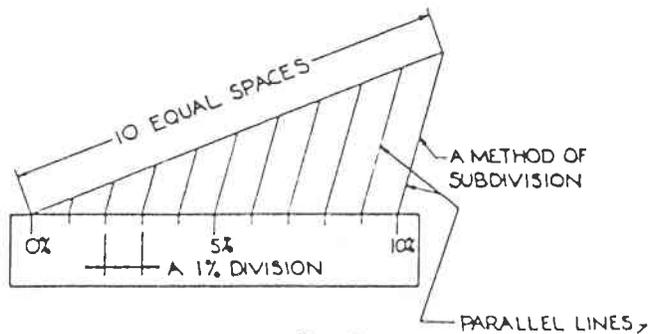
- ¹ Schrenk, O. *A Simple Approximation Method for Obtaining the Spanwise Lift Distribution*, N.A.C.A. T.M. No. 948, 1940.
- ² Flatt, J., *Evaluation of Methods for Determining Spanwise Lift Distribution*, Army Air Force Technical Report 4952, 1943.
- ³ Weissinger, J., *The Lift Distribution of Sweptback Wings*, N.A.C.A. T.M. No. 11120, March, 1947.
- ⁴ Theilheimer, F., *Influence of Sweep on the Spanwise Lift Distribution of Wings*, Journal of the Aeronautical Sciences, Vol. 10, No. 3, p. 101, March, 1943.
- ⁵ Van Dorn, N. H., and DeYoung, John, *A Comparison of Three Theoretical Methods of Calculating Span Load Distribution on Swept Wings*, N.A.C.A. T.N. No. 1476, 1947.



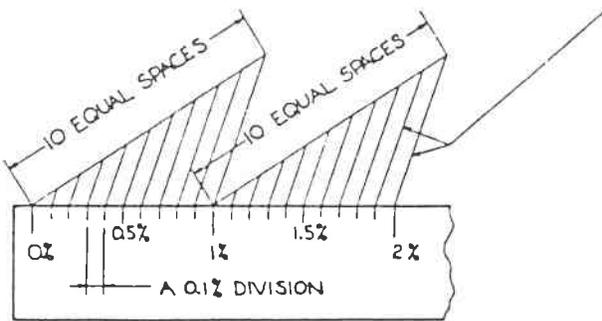
Step 1



Step 2



Step 3



Step 4

Plotting An Airfoil

By Prof. Kenneth S. Woodard, EAA 9252
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 360 Huntington Ave., Boston, Mass.

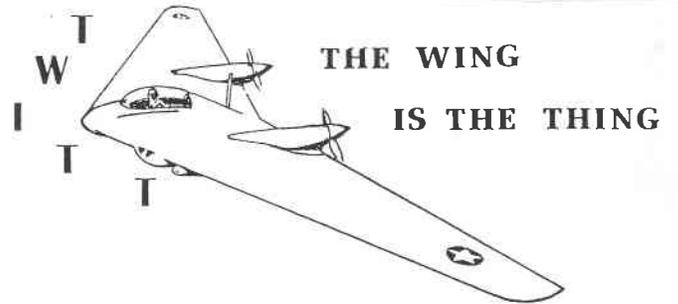
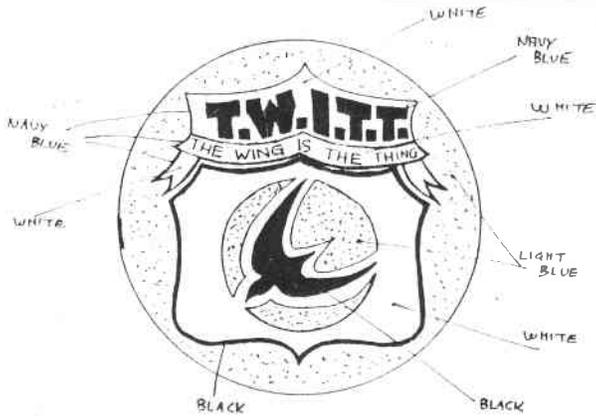
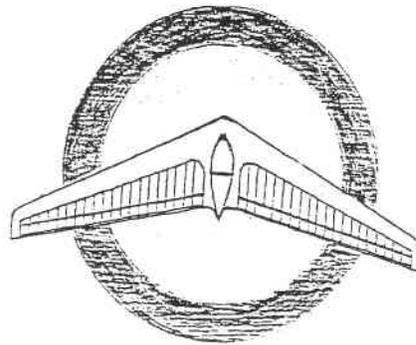
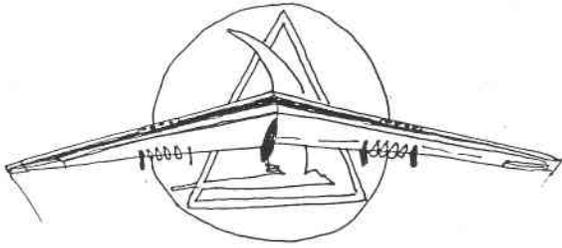
WHEN PLOTTING an airfoil it is not necessary to convert percent chord values to actual inch dimensions if a percent scale is used. This scale is simple and quick to make and the extra work of calculating the actual dimensions is eliminated. This method is more accurate because the percent values are used directly rather than the rounded off inch values.

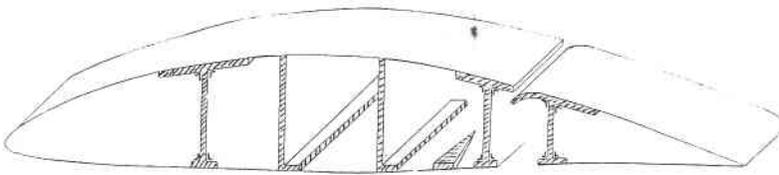
To construct the percent scale find the actual chord length of the airfoil to be plotted. Divide this actual length by 10 to obtain 1/10 of the chord. (See sketch, step 1). To make a 10 percent scale obtain a strip of reasonably stiff paper and accurately mark off on this strip a length equal to 10 percent of the chord. (See sketch, step 2). Subdivide this length into smaller divisions as necessary. (See sketch, steps 3 and 4).

This scale is used to measure distances just as any ordinary scale is used. If the upper ordinates are larger than 10 percent it is advisable to make a 15 percent or 20 percent scale.

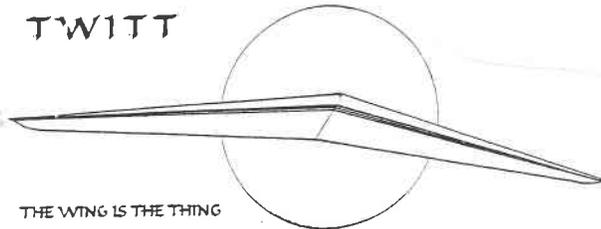
Another view of the SWIFT being moved to the flight line at Torrey Pines. (Photo by Floyd Fronius)



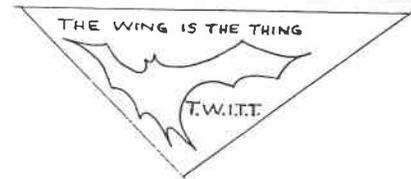




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