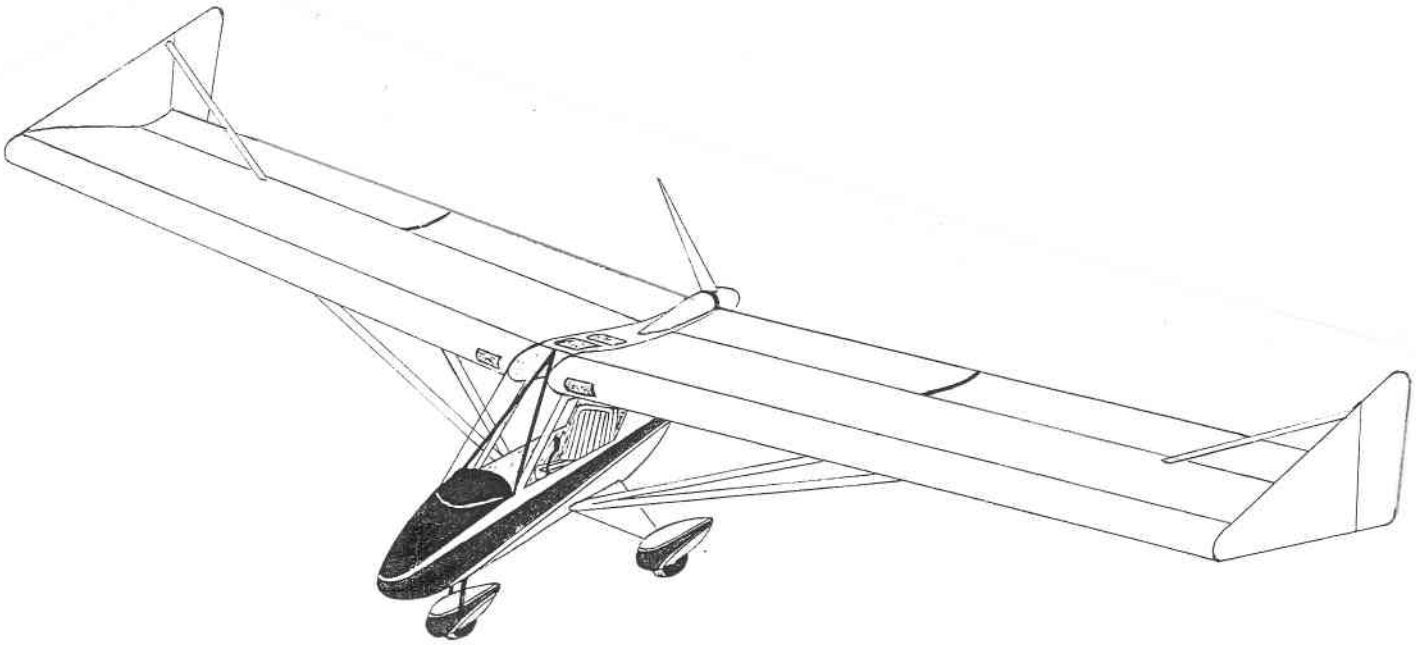
No. 96 JUNE 1994

T.W.I.T.T. NEWSLETTER

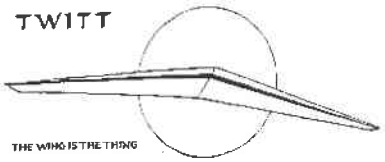


ABOVE: Larry Watson's design he thinks resembles the Stripplin Skyranger. He has nearly completed the fuselage. See page 9 for more on this project.

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., **9406** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, July 16, 1994, beginning at 1330 hrs at hanger A-4, Gillespie Field, El Cajon, CA (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 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.

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

President:	Andy Kecskes	(619) 589-1898
Vice Pres:	Bob Chase	(818) 336-5485
Secretary:	Phillip Burgers	(619) 563-5465
Treasurer:	Bob Fronius	(619) 224-1497

Editor: 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) 596-2518 (10am-5:30pm, PST)
(619) 224-1497 (after 7pm, PST)

Subscription Rates:
$18 per year (US)
$22 per year (Foreign)

Information Packages: $2.50 ($3 foreign)
(includes one newsletter)
Single Back Issues of Newsletter: $1 each (US)
Postage Paid
Multiple Back Issues: $0.75 ea + bulk postage

Foreign mailings: $0.75 each plus postage

Wt/#Issues	FRG	AUSTRALIA	AFRICA
1oz/1	1.00	1.00	1.00
12oz/12	5.00	6.75	5.00
24oz/24	9.00	12.25	9.00
36oz/36	14.00	19.50	14.00
48oz/48	16.75	23.00	16.75
60oz/60	21.75	30.25	21.75

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).

TABLE OF CONTENTS

PRESIDENT'S CORNER

For those of you who live in the Southern California area and didn't get out to Hemet for the annual Vintage Sailplane Association regatta, you missed something special. There weren't any flying wings (Bernie Gross was absent this year), but there were many other interesting restorations. Mark your calendars for the Labor Day weekend and make a point to attend the Sailplane Homebuilders Association annual event at Tehachapi and catch up on what is going on in the world of homebuilders.

I want to apologize to those of you who have ordered video tapes. I have been tied up with other things, but am now getting started on the backlog. They should start hitting the mail about the same time as this newsletter, so please be patient since they are sent at the book rate with takes 8-10 days.

Eugene Turner has sent us another large package of material, much of it delta shape flying wings, most of it in the area of hand-launched or powered models. Next month I will try to publish a list of what is available, and I will be including copies of the better diagrams as time and space permits over the next several months. If you find anything of interest, I suggest you correspond or talk directly with Eugene (the fastest way to get a copy or more information).

I have another good batch of mail for next month's newsletter, along with some catchup articles that I think you will find interesting. So, don't go away, there's more to come for everyone.

Yes we are working on an index of what material is in past newsletters, but it will be at least several more months before it is ready for publication. The listing of library material still has not gotten off the ground, so if there is anyone out there who would like to help with the project, please give me a call.

If anyone out there has something they could present for the July program to supplement our annual birthday party, please contact Bob as soon as possible. It doesn't have to be fancy or elaborate, just something that would be of interest to the general membership.

Andy

JULY 16, 1994 PROGRAM

As of publication date we did not have a firm program for the July meeting. This will be our anniversary meeting (versus June), along with the annual meeting (in case anyone wants or needs to conduct any business). We do know there will be cake and ice cream, which will taste good on a hot summer's day.

Please mark your calendars now for July 16th, and plan on coming out for some hanger flying and other socializing. If you want to bring along your latest flying wing model creation for a fly-off contest, we are sure there will be some others there to compete against.

HIGHLIGHTS OF THE MAY 21, 1994 DEDICATION

The ceremony dedicating a historic marker for early sailplane flights from Point Loma was initiated by Don Hunsaker, on behalf of the Environmental Trust and other co-sponsors; Ryan Foundation, TWITT, AGSSC, Allen Airways, Scanivalve Corp., and Teledyne-Ryan Aeronautical.

Although this was advertised as a combined event to include TWITT, the majority of the program was devoted to the history of flight from the Point Loma sites. The dedication was attended by over 60 aviation enthusiasts, both young and old, who welcomed Bill Chana as the keynote speaker. Included in this group were such notables as Mrs. Hawley Bowlus and members of her family.

Bill's commentary included an overview of the history behind the flights conducted during the late nineteen-twenties and early nineteen-thirties. Some of the more noteworthy pilots to make these flight included Charles and Anne Lindbergh, Hawley Bowlus, Bud Perl, Dick Essery, and Forrest Hieatt (noq 95 years old, who was present at the ceremony). Most of these flights were made in Bowlus aircraft, including his famous Albatross.

The site is marked with a large granite stone with the commemorative plaque, with the following inscription:

"IN COMMEMORATION OF THE EARLY AVIATION PIONEERS THAT FLEW AMERICAN DESIGNED AND MANUFACTURED SAILPLANES IN SAN DIEGO. THESE AVIATORS ARE REMEMBERED BY THOSE WHO FLEW AFTER THEM AND THE CITIZENS OF SAN DIEGO."

Along with the names mentioned above, the plague contains these names of San Diego's early aviation pioneers:

J. Barstow
W. Beuby
L. Bullen
A. Hastings
I. Lawson
E. Mitchell
A. Moore
W. Van Dusen

There is also another mounting station on the stone for a plague from the National Soaring Museum, designating the site a National Soaring Landmark. This will be put in place at a latter date.

The site was made available through the efforts of Captain Kirk Evans, Commanding Officer, Don Lydy, and the personnel of the U.S. Navy from the various operational commands on Point Loma. They set aside the small amount of land for the marker, cleared the area for the ceremony, and helped put the large stone in place.

There were two static display aircraft, a Baby Bowlus belonging to Wayne Spani and the partially rebuilt fuselage of a Bowlus Albatross belonging to Raul Blackstein and Harry Irvine, all members of the Vintage Sailplane Association. The program was concluded by Gary Fogel with a radio control slope soaring flight by a 1/4 scale Baby Bowlus, along with a fly by of a 1930 Stearman Speedmail and Grob 109 motor glider.

After the official ceremony, there was a lot of picture taking with the Bowlus family around the monument. Many people took advantage of Wayne Spani's offer to have a picture taken "flying" the Baby Bowlus (leather helmet, goggles, wind blowing in your hair) with the Pacific Ocean as a backdrop. (Wayne wanted to turn the glider around and have him pushed into the wind for a real flight, but it was not to be.)

Everyone appeared to have a good time, and there were many old friendships rekindled among the attendees.

For you local members, if you missed the ceremony, make a effort to drive out to the Point on a clear day and witness the spectacular view of San Diego and the Pacific Ocean from the soaring monument. There is limited parking right next to it, and you do not have to enter the Cabrillo Monument park (the marker is just short of the road that goes down to the tidal pools at the bottom of the Point).

(Note: If anyone is interested in listening to the text of Bill Chana's comments, they are available on cassette. Give us a call.)

LETTERS TO THE EDITOR

4/10/94

TWITT:

Thanks for sending me the video tape with the additional material.

Probably the most fascinating part of the tape was the old home movies from Texas Soaring

Association. I am currently an active member of TSA, and I will be sharing this tape with the club. The scenes with the Horten IV are from the 1952 National Soaring Contest at Grand Prairie Airport here in Texas. The gentleman in the red baseball cap getting in and out of the Horten is Rudy Opitz, who is also famous as one of the test pilots for the ME 163 program. Rudy is still active in soaring and now lives in Stratford, Conneticut. The Fauvel glider shown in the tape belonged to Hal Lattimore, one of the founders of TSA, and past president of the SSA. The Flying Plank, of course, belongs to Al Backstrom, who was also one of the early members of TSA.

Thought you might enjoy knowing more about what you had on the tape. If any of the older members of TSA can identify anyone else, I'll pass the information along.

Regards,
Kevin Renshaw

(ed. - The film clips came from the home movies of June Wiberg, a long-time TSA associate {she edited a couple of the items you mentioned}. There was a lot more, but since they were somewhat personal I only extracted the bits and pieces which had flying wing material until I got to the old German film. Her husband, Wally, was also one of the people trying on the Horten for size.

Some of your early recipients of the videos may not have the portion mentioned by Kevin, since it came available after some of the initial tapes were sent out last year.)

5/1/94

TWITT:

Enclosed is my check to cover a one year membership plus some extra for your last four issues of the newsletter.

Also, I could really use either coordinates for the Eppler 222, 226, 230 airfoils, OR even better, fairly large templates of same. Even some popular books on airfoils do not contain this Eppler series.

Thank you,
Terry A. Blake
600 57th Street
Downers Grove, IL 60516-1441

(ed. - We would like to welcome you to TWITT and hope you find the issues Bob sent you were interesting.

If any of our members out there could help Terry with his request or at least put him on the trail of the airfoils he is looking for, I am sure he would appreciate it.

We are trying to make contact with a person who might have access to an extensive library of NASA material, which might help with your problems. We will let you know if anything comes of this effort.)

5/17/94

TWITT:

Dr. Glenn Sembroski's letter in the May 1994 issue of the TWITT Newsletter mentioned Jerry Blumenthal's RATTLER, and your editorial comment mentioned that "someone on the east coast...had undertaken a larger scale model."

The builder of the RATTLER model was/is Jim Ealy, a well know scale modeler who has quite an extensive catalog of plans for his various creations. We are not sure of the status of the RATTLER model. You might ask Jim directly. He can be reached c/o The Peddie School, Hightstown, NJ 08520.

We've sent a postcard to Dr. Sembroski with this information.

The condensation of our notes came out great. Thanks! It would appear from other letters that we were not the only members to think along these lines. It's comforting to have one's thoughts receive confirmation.

Sincerely,
B^2
(Bill & Bunny Kuhlman)

(ed. - Thanks for the help in getting Glenn in touch with Jim. Hopefully, it will produce something for both of them. Jim used to be a member of TWITT, but dropped out sometime ago. Maybe this will get him back with a progress report on the RATTLER since he knows someone else is interested.

I know Jerry Blumenthal would be very pleased that his concept designs where being used by someone to produce a better flying wing.)

TWITT:

I am a member of the SHA and have noticed your ad in the Sailplane Builder. Enclosed is membership for one year along with some extra for a back issue and a photocopy of the following: I am looking for an airfoil for an improved plank type wing with swept tips. If you have any information on this following please send them along: Airfoil - possible laminar section with a usable C/L of .8-1.0, Max C/L of 1.1-1.2. Request source for table of ordinates and any additional data.

Also looking for ordinates for Wortman FX 05 H 126 series sections.

Thanks,
Don Macey
P.O. Box 581
Carnelian Bay, CA 96140

PS: I have data for EPB-1 plank, Fauvel sections, and Marske 23012-75 sections.

(ed. - Bob sent this letter to Al Backstrom who provided the following to Don.)

This is in reply to your letter to TWITT

requesting airfoil data. I am enclosing a copy of the little bit of data I have, i.e.:

1. Airfoil ordinates for Marske Monarch and Pioneer 2D.
2. Ordinates for FX-66 H-149 with letter stating it has not been wind tunnel tested.
3. Drawing of a John Roncz airfoil (I think Jim Marske sent me this).

Sorry to have so little. I suggest you contact Jim Marske on airfoil data as he has been more active in this area than anyone I know of.

Al Backstrom

(ed. - We would like to thank Al for providing the material he did to Don. As I mentioned in a prior letter, we are trying to get access to more airfoil information.

If Don doesn't have Jim Marske's address, it is: 975 Loire Valley Drive, Marion, OH 43302, (614)389- 6055.)

5/16/94

TWITT:

I saw a David Hatfield at the Northrop University in the late 70's. He was short and very friendly. He was collecting all the Northrop pictures, stories, interviews, etc., and making a video library. He passed away not finishing this project.

I was able to purchase some of the photos that he had. I sent you copies of just a sample of the thousands of items that I have collected. SO, if you want a clearer copy of the photo, or a full size blue print, etc., just say which one you want.

It is sad the know that one must be dead before the public will recognize his/her talents. Mr Horten will now be recognized as a genius, posthumously.

In the May 1994 issue of the newsletter Edwin Sward showed a love of "circular aircraft." I once had a desire also. I have a small section of plans and drawings of what I call "flying saucers." You always say tailless or flying wing so I did not mention saucers before.

I also have dirigibles, submarines, seaplanes, flying boats, float planes, a few CrisCraft boats, P-38, Constellation, etc., etc. If it is odd, I have it.

Thanks,

Eugene Turner
12469 Walsh Avenue
Mar Vista, CA 90066-6607

(ed.- Thanks for the information letter. We would appreciate it if you could send us, from time to time, as good a picture as you can produce of the various types of planes members mention in their letters. This would enable us to show others what has been done in the past, and maybe prevent some costly duplication of a bad idea.

I will sort through the mass of material you have already sent and try to catalog it as I put it in the library. If there is anything of interest I will be asking you for a better copy. And thanks for all your contributions, they're super.)

(ed. - The following comments were submitted by Phillip Burgers, TWITT Secretary. Figures 4 and 5 from the December 1986 newsletter have been included so those of you who do not have any of the early issues will not be in the dark about what Phillip is talking about, and won't have to order it if you don't want to.)

ABOUT THE ABC OF "e" AND A NOTE ON TWITT'S INFATUATION WITH FLYING WINGS

I would like to comment on the lines written by Mr. Karl Sanders in our last TWITT issue (May '94). First he refers to a past article signed by Serge Krauss. Mr. Sanders finds the missing link in Mr. Krauss equations: the seemingly innocuous Oswald factor. It has always surprised me that this factor "e" has transformed itself, from a lower case, insignificant "fudge factor" introduced in 1932 by Mr. W. B. Oswald to one of the most important "rule of thumb" type parameters in aircraft design and also one of the most often over-inflated parameter in the predesign stage of airplanes.

Let me justify this last sentence. It is known that the Oswald factor (also called span efficiency factor) is normally estimated between .7 and .9. It so happens that the wing of a Piper Arrow II, which does not have a wing planform that is out of the ordinary, has an Oswald factor is 0.52..!! (obtained from test flights). One more definition of the Oswald factor before ending this subject. In an article by Frost and Rutherford, it says and I quote:

> *"The wing that produces more Cl_α per unit aspect ratio will have a higher span efficiency."*

...which I think is a neat concept.

Now, regarding the other comment by Mr. Sanders regarding TWITT being "infatuated..." and I quote...

> *"...with the flying wing/tailless species...which are not the best nor the most practical and economic solutions...."*

Unfortunately, there is not much I can say to counter these statements. My position, when trying to defend these configurations is even more shaky after having discussed the concept

of the Oswald factor in airplanes! Anybody would like to guess the value of the Oswald factor of a flying wing ?? Calculated Oswald factor of the flying wing Horten IV is around 0.55 (superior to the Piper Arrow II....!!??!?).

Admitting that this last comparison is not fair, due to the fact that, yes, Oswald factors of conventional airplanes are substantially higher than those of flying wings, I still would like to make a point about the spirit of the lines of Mr. Sanders in the last TWITT newsletter issue.

very clumsily at that! At this early stage these apparatus need crutches (a tail to hold the horizontal plus vertical surfaces at a fairly good distance from the center of gravity) to help keep the airplane from falling from the sky. This is a stability problem that has been solved in a very primitive way. These airplanes are what we would call "stability configured" airplanes. These flying machines are analogous to us, when small, learning how to walk. We would concentrate in walking and trying not to fall. The word stability was in our minds at all times. Later on, we learn

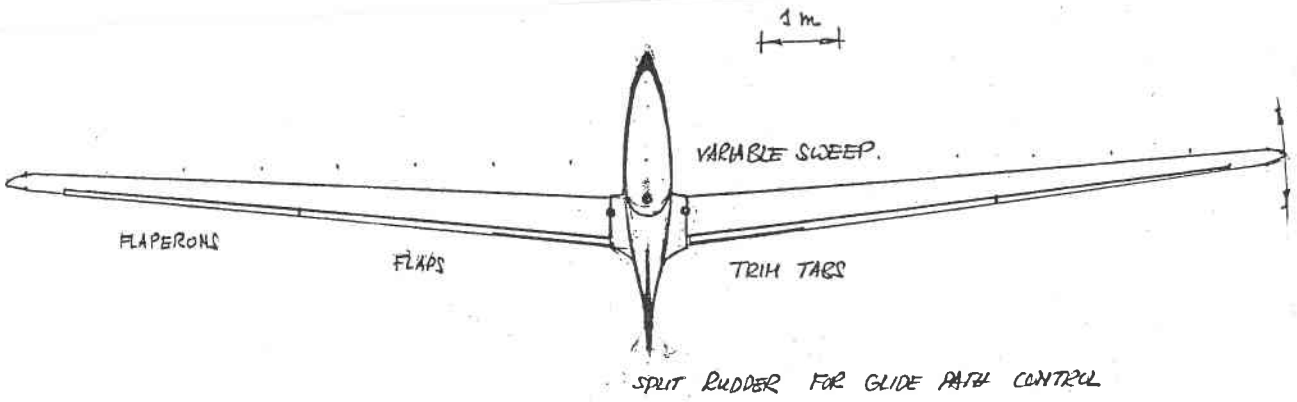


FIGURE 4

CONFIGURATION WITH ACTIVE STABILIZATION

Flying wings and their family tree, the delta, ogive and gothic wings are all around us. It is true that these configurations not only share the same stability problems and similar awkward lift distribution and low moments of inertia around the spanwise "y" axis, etc., but strangely enough it is also true that flying wings of various types are all surrounding us in so many forms, that we even do not realize.

Seeds, insects, kites (I just bought one ...for my son, of course...and he'll have a chance at it... one of these days...OK?!!), bats, birds (remember they don't have a tail, just a powerful flap that induces a big nose down pitching moment as all good flaps do) *{Bob - The chord wise location of the flap hinge line determines the good or bad pitching moment}*, hang-gliders at Torrey Pines, underwater rays, delta winged fighters, flying squirrels, stealth fighters and wing bombers and several Concordes. As we see, the flying wing is probably the favorite configuration Mother Nature (unfortunately not yet a member of TWITT, but we are working on it) selected as the way to fly. She likes flying wings because they are, in the evolutionary sense, very economical and efficient. For this reason the "natural flyers" have been able to survive for millions of years.

In contrast, the "artificial flyers" are only 90 years old...just started flying..and

how to run and change direction while running and we never think of stability in a conscious way...!!!! At this stage, a quantum leap will occur and airplanes are going to be referred as "control configured" designs. We are not still at this stage. Stability is still the stumbling block in order for us to obtain superior performance of our flying vehicles.

Some readers may ask, well, give us a good example of a so called "controlled configured" airplane..!!! I am not referring to modern fighters that are actively controlled by their horizontal surfaces. This is still a sophisticated type of crutches. For the real stuff, lets hear what Northrop had to say as part a of a presentation during the 35th Wilbur Wright Memorial Lecture and I quote him:

> *"...a possibility of rather unconventional nature remains to be proved in the all wing aeroplane. This consists of placing the C.G. behind the aero-dynamic center of the wing, eliminating inherent longitudinal stability by so doing replacing this characteristic ...by highly reliable automatic pilot which takes over the function of stability from the airframe and may perhaps do a better job of maintaining the proper attitude than the present classical method...If the C.G. is located aft of the aerodynamic center, the airplane will*

trim at a high angle of attack with the flaps or elevator surfaces deflected downward rather than upward from their normal position, thereby increasing the camber and rendering the whole aerofoil surface a high lift device...
...and that the question "why bother with an all-wing aeroplane?" is already well answered"

These words were said in 1947...and we are still unable to see this idea fly...due to our technological limitations and liability affairs.

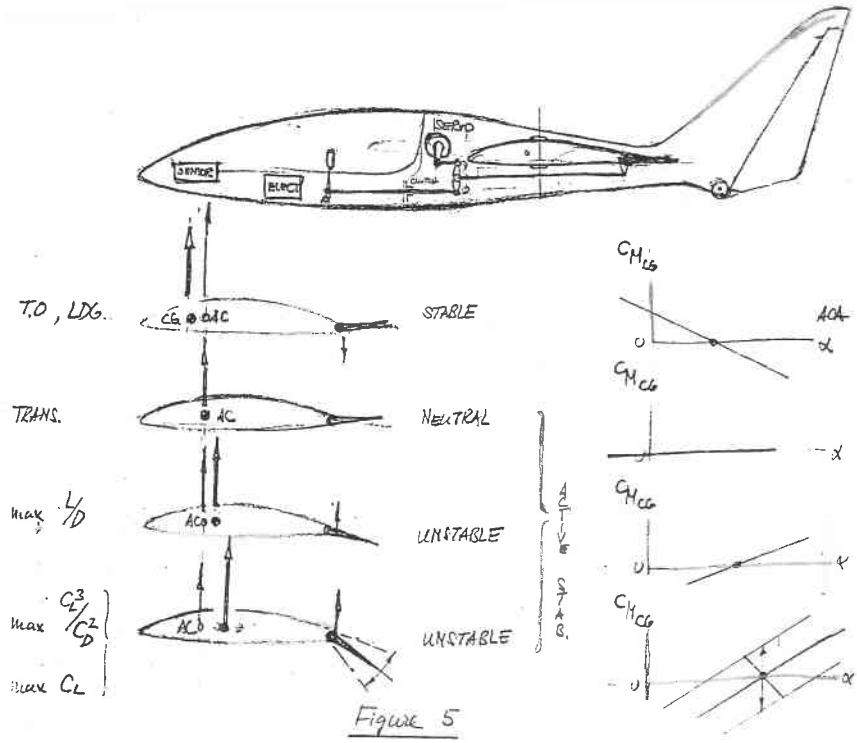


Figure 5

Along the same lines, in one of the most memorable TWITT newsletters ever published (my very subjective opinion, if you allow me), the one dated December 1986 (number 6), the above words are translated into a real airplane design by Mr. Hernan Posnansky *(Bob - Hernan's idea that led to the creation of TWITT)*. If Jack Northrop's words are a little unclear, let me suggest you to read the above quotation again and refer to Figure 5 on page 14 of the aforementioned TWITT newsletter for a better understanding.

Many of us have regarded this project to be TWITT's ultimate goal (unreachable for now due to the economics and the forever eternal sad state affair of the liability issue). This is exactly what the ultimate in flying wings, the birds do: variable wing sweep (with not more than ± 3 to 5 degrees total) for trimming purposes and the C.G. aft of the A.C. when gliding in a thermal or in need of efficient flight. *(Bob - Henan looked at hydraulics and electric motors to give faster than human response to the control surfaces.)*

I urge TWITTers to keep this aforementioned issue in a safe place. If you don't have this issue, get it. In years to come this idea will be the way to go, and then you will have a chance to refer to the origins of it, back to Northrop and TWITT.

After solving the stability problem, a quantum leap will occur. At this stage it will become obvious that once we get rid of the aerodynamic crutches, the flying wing will be the obvious choice for a very large and varied types of requirements, not only gliding and soaring. Flying wings will be so efficient that all other airplanes with crutches (or "tails") and other "stability configured" vehicles will be seen in museums and "control configured" vehicles will take the sky. That is, in my opinion, what TWITT strives for and has contributed significantly in this sense. Talking about contribution...

There is one more reason for me trembling at the idea of TWITT going back to conventional flying stuff: if this would happen, we would not read any more about the highly authoritative opinions on flying wings of one of the individuals that, having started with his own design experience in flying wings with nobody less that with Dr.Reimar Horten in Argentina, has given us, at the TWITT gatherings and through its newsletter, together with Irv Culver and few other giants of aviation like Mr. William Sears (Northrop's aerodynamicist), much of the valuable and valued specialized technical knowledge that TWITT has spread so generously around the world through its newsletters.

I'm obviously referring to the major quality input that Mr. Sanders has offered all TWITTers...
Thank you, Karl Sanders...!!!!

Related References :

1) "An Application of the Carson Cruise Optimum Airspeed - A Compromise Between Speed and Efficiency" by Hubert C.Smith, The Pennsylvania State University.

2) "General Formulas and Charts for the Calculation of Airplane Performance" by W.B Oswald, NACA TR 408, 1932.

3) "Aspect Ratio Corrections" by K.D.Wood. Journal of the Aeronautical Sciences - October 1943.

4) "Subsonic Wing Span Efficiency" by Richard C. Frost and Robbie Rutherford. AIAA Journal, Vol. 1, No.4 April 1963.

5) "The Development of All-Wing Aircraft" by John K. Northrop at the 35th. Wilbur Wright Memorial Lecture.

6) "Active Stabilization of Tailless Sailplanes", TWITT Newsletter, No. 6, December 1986

(ed. - The following is a condensed version of an article Kevin Renshaw has submitted to both Soaring magazine and Sailplane Builder. I have tried to get the most useful information out of it without going into the details of how he derived the data. If you are interested in reading the entire article before it is published in one of the other magazine you may receive, send us $1 and we will mail you a copy.)

Wetted Area and L/D

Aircraft designers are constantly searching for the most efficient aerodynamic design for their products. In the case of sailplanes, the thing we are typically interested in is max L/D. Many people thing that to increase L/D, you simply increase wing aspect ratio, but this is only part of the equation. Looking at the aspect ratio alone ignores the contribution of the rest of the airplane to total drag. A better measure of merit for aerodynamic efficiency can be calculated by comparing the wingspan with its total wetted surface area. An aircraft that has a high ratio of span to wetted area will have a high aspect ratio wing. Conversely, you can start with a high aspect ratio wing, but end up with a lower performing design if the fuselage and tail are not designed properly.

For those not familiar with the term "wetted area", it is simply any and all areas of the aircraft that air passes over while in flight. Wetted area is one of the major factors in determining both the drag and weight of any aircraft. Drag can be divided into three major components: profile drag (affected by airfoil selection, fuselage contours, and frontal area); friction drag (affected by wetted area and surface friction coefficients), and; induced drag (drag due to lift, affected primarily by span). Wetted area is also used to calculate preliminary design weights by multiplying area times unit weights (pounds per square foot of metal, fiberglass, wood, etc.).

About the Data

The total wetted area of a variety of sailplanes was calculated using drawings published in Soaring and in the Sailplane Homebuilders Association newsletter over the past 20 years. Using a plan and profile view of the sailplane, I drew a cross section of the fuselage every 25". The perimeter of each section was measured using a map measuring device, and the perimeter value at each station was plotted against fuselage station (see Figure 1). The area under this curve represents the surface area of the fuselage. *(ed. - The wings and tail surfaces were similarly done.)* The calculated values are listed in Table 1.

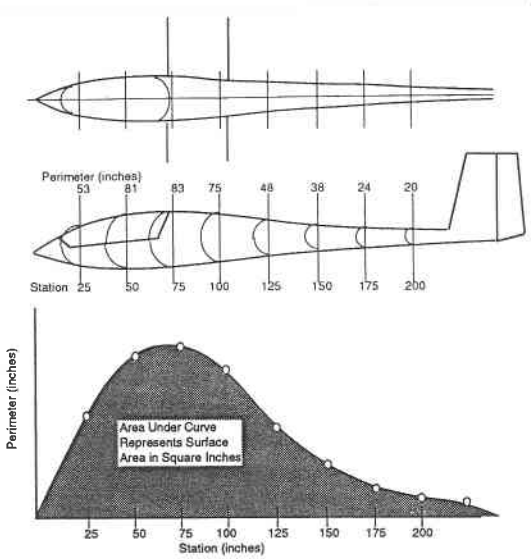


Figure 1 - Fuselage Wetted Area Calculation

I gave the data a "sanity check" by comparing relative values for similar designs (e.g., a Ventus B should have more fuselage area than a Ventus A and less than a Nimbus). I feel the data is accurate to ± 5% and the overall relationships are correct.

Design	Fuse (sq. ft)	Wing (sq. ft)	Vert Tail (sq. ft)	Horiz Tail (sq. ft)	Total A_{wet} (sq. ft)	Span (ft)	Span/ sqrt A_W	L/D max
SGS 1-26	108.1	316.2	27.2	35.5	487.0	40.0	1.81	21.0
PW-5	71.1	206.6	14.2	24.5	316.3	43.6	2.45	32.5
Marske Genesis	54.0	232.8	23.8	13.2	323.8	49.2	2.73	43.2
SB-13	51.7	245.4	31.3		328.4	49.2	2.71	41.5
Monerai	65.0	152.9	18.6		236.5	36.0	2.34	28.0
Pioneer IA	63.0	394.1	25.6		482.7	46.0	2.09	35.0
Pioneer II	42.7	303.7	30.2		376.6	42.6	2.20	35.0
Minibat	45.2	120.6	17.2		183.0	25.0	1.85	25.0
Horten IV	12.1	422.2			434.3	65.6	3.15	37.0
Rutan Solitaire	73.6	165.2	12.2	33.7	284.7	41.0	2.43	28.0
Duster	79.3	204.0	15.6	21.6	320.5	42.7	2.38	29.0
Windrose	79.7	194.1	20.9	21.7	316.4	41.5	2.33	29.0
Strojnik S-2	76.3	246.1	18.9	28.4	369.7	49.2	2.56	34.0
HP-18	81.5	224.0	31.4		336.9	49.2	2.68	38.0
Amer. Spirit	80.6	210.9	19.9	21.4	332.8	49.2	2.70	42.0
PIK-20	73.6	220.5	18.9	21.5	334.8	49.2	2.69	39.7
DG600/15	83.0	228.7	18.4	21.5	351.6	49.2	2.62	40.5
DG600/15 W*	83.0	232.2	18.4	21.5	355.1	51.9	2.75	42.0
DG600/17	83.0	247.0	18.4	21.5	369.9	55.8	2.90	46.0
Discus B	77.2	212.5	18.2	18.8	326.7	49.2	2.72	42.5
Ventus A	74.2	204.5	19.9	21.1	319.7	49.2	2.75	44.5
Ventus B	78.1	204.5	19.9	21.1	323.6	49.2	2.74	45.0
Ventus A / 17	74.2	218.3	19.9	21.1	333.5	54.5	2.98	50.0
Nimbus 3 / 22.9	82.6	348.6	24.8	22.8	478.8	75.1	3.43	50.0
Nimbus 3 / 24.5	82.6	358.4	24.8	22.8	488.6	80.4	3.64	60.0
ASH-25	109.8	346.1	31.5	28.8	516.2	82.0	3.61	54.0
ASK-21	131.6	387.7	28.2	38.1	585.6	55.8	2.30	35.0
Grob Twin II	118.2	370.6	27.4	48.6	564.8	57.5	2.42	35.0
Space Shuttle	6311.0	4183.0	867.0		11361.0	78.1	0.73	3.0

* W = winglets

Table 1 - Wetted Area Data

L/D Versus Span and Wetter Area

Wherever possible, I used the results of Dick Johnson's flight tests for the max L/D values. Since Dick doesn't test many homebuilts, for these aircraft I used values

published by the designers (caveat emptor). The plot in Figure 2 shows a generally linear relationship between L/D max and span divided by the square root of wetted area. By using the square root of the wetted area, the values across the bottom scale are non-dimensional (i.e., feet divided by feet). The upper band covers the factory built glass ships with significant laminar flow designs. The lower band generally includes most homebuilts and sports class ships.

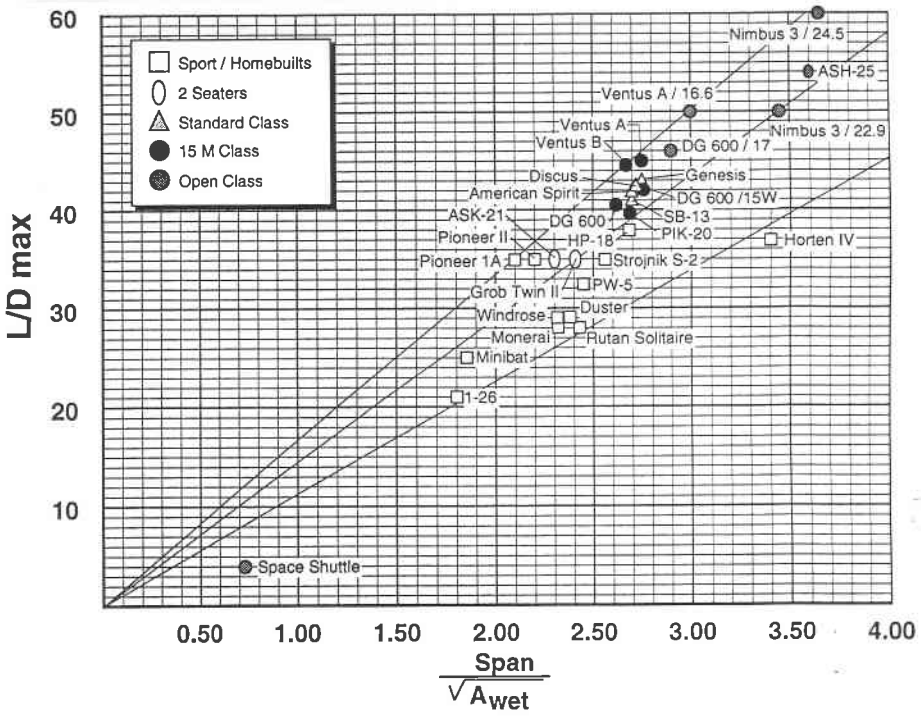


Figure 2 - L/D Max versus Span Divided by Square Root of Wetted Area

It is interesting to note that a large number of 15 meter and Standard class ships all cluster around a span to area ratio of about 2.7. This includes the SB-13 flying wing design from Akaflieg Stuttgart and the new Genesis design from Jim Marske and John Roncz. In looking at the data, there is less than 10% difference in total wetted area between any of the state of the art 15 meter ships. It is also interesting to note how close all of the tail sizes are.

The designs that have tip extension allow excellent comparison of varying span while holding fuselage and tail wetted areas constant. (The plot compares the Ventus A at 15 and 16.6 meters, and the DG 600 at 15 and 17 meters.) The DG 600 was also tested with winglets (DG 600/15W) and this data shows that winglets give an effective increase in span equal to their height with very little added wetted area.

What Does This All Mean?

Obviously this relationship between span and total wetted area is not lost on the designers of modern competition sailplanes. The trend over the last 20 years has been toward tighter cockpits, slimmer tail booms, smaller wing areas, and smaller tail surfaces. All of these things reduce wetted area.

One interesting idea is the variable area wing examined by one of the German Akafliegs several years back. Ideally, you could retract the flaps into the fixed portion of the wing to decrease wetted area for max L/D, and then extend them for low speed thermalling and landing. Complicated, but theoretically workable.

Another approach is to work hard on weight reduction, so that you could achieve the low speed performance with a smaller wing and tail area, while holding the span constant. The limiting case here would probably be wing stiffness and flutter. Once again, these problems are difficult, but not impossible to work.

When I started this study, I expected to see a big benefit for flying wing type sailplanes. The logic seemed simple: no horizontal tail, no tail boom, less wetted area, right? This is true up to a point. On the down side, since a tailless design can't be trimmed to as high a coefficient of lift as a tailed aircraft, the flying wing usually needs more wing area (hence, more wetted area) to get the same low speed performance.

The only standouts among the flying wing homebuilts are the Pioneer series by Jim Marske, which both show up in the competitive band. With some better airfoils and a tighter cockpit, there might still be something there.

The Horten IV comes closest to realizing this idea. The Horten was a 20 meter all-wing design (circa 1938) with a small bubble canopy and a small lower pod for the pilots legs. It's relatively poor performance (in spite of a span/area ration of 3.15) can probably be attributed to the very thick airfoils used and the completely non-laminar flow caused by its wood and fabric construction. The Horten also carried more wing area than we would use today, as it was designed for a wing loading of only 3.5 pounds per square foot.

While homebuilt sailplane designers aren't all out to create the next Nimbus 3, we should still make the best use of wetter area and span. Some things that add wetted area include upright seating (1-26) and slab sided or faceted fuselages. One thing to watch out for is excessively steep aft slopes on pod and boom

type sailplanes which can cause flow separation that negates any benefit from reduced wetted areas.

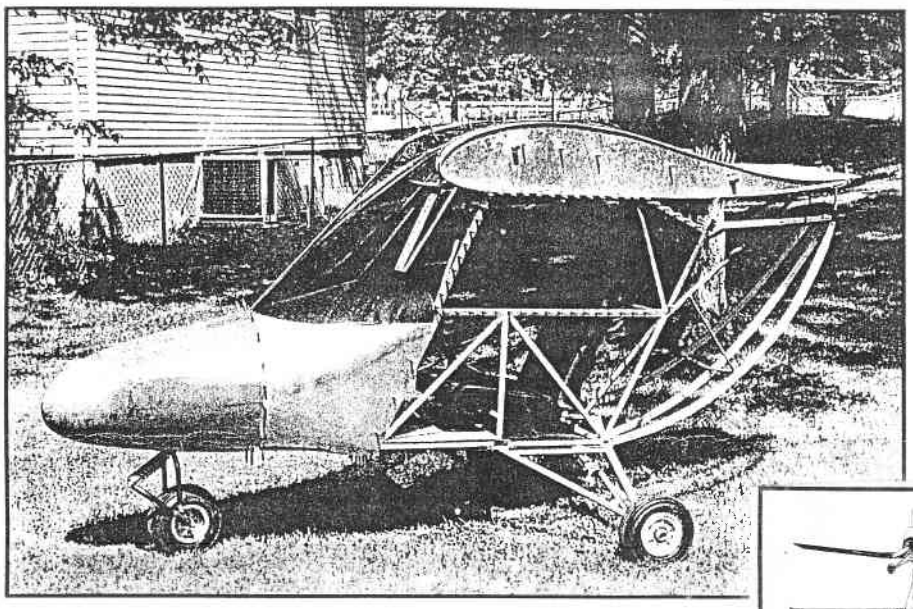
I am starting to come down on the side of those that say if you are going to build a sailplane, it's just as easy to built a 15 meter wing as it is to built a 13-14 meter wing.

What it all comes down to is this: wingspan is the best use of wetted area. Anything else is counterproductive.

(ed. - Last month Chris Tuffli sent us some material on a flying wing project being built by Larry Watson of Caryville, TN. We sent Larry a complimentary copy of the newsletter to see if we could interest him in TWITT. Although he hasn't joined (yet) he did send us the following about himself and his work.)

I have just received a copy of the TWITT Newsletter, Thanks! I am glad to find that I am not alone in my love for tailless airplanes. I also would like for your readers to know that I have designed and built several tailless airplanes. I started with RC models and developed three full scale man-carrying planes.

The first one is almost complete except for the wings. The other two are mostly parts and drawings right now. The RC model has been flying for 8 years with no crashes yet.



I have enclosed some pictures and drawings of two, along with a short article. If you would care to put these in your newsletter, along with my address, it is okay. I hope to make plans and parts available when I get mine flying.

(This is an update of his article that appeared in the March 1994 issue of Experimenter.)

I've always had a fascination with unusual aircraft. The ones without tails always caught my interests. I've flown radio control models since 1970 and built several models of gliders and power planes without tails. A couple flew really well, but they didn't look like real planes. So I set out to build a model that looked like a full size plane. I finished the model not expecting it to fly, but it flew so well that I still have it today after finishing it in 1986.

Being a member of EAA, I watched the new ultralight movement with great interest. I thought how great it would be to build my model into a full-size plane. I worked on some drawings and came up with an entirely different looking plane than the model I built for RC. It resembles the Stripplin Skyranger, I think, a high wing, single seat pusher.

I have been working on the plane now for over 2 years off and on. The fuselage is almost ready to cover. I have finished the control system and motor mount. The wing I haven't started yet, but I expect to soon. I used a drive system for another ultralight that has already been around for a few years.

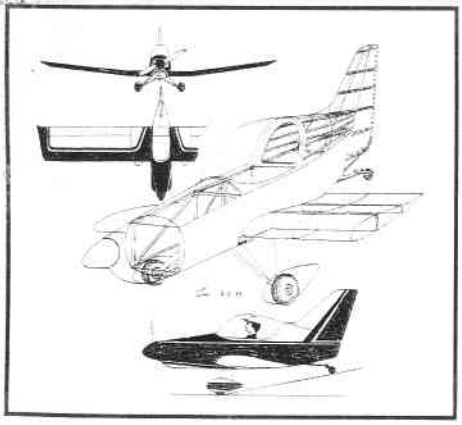
The fuselage is of steel tube construction with laminated wood stringers giving shape to the rear section. Aluminum sheet was used for the center section overhead and around the cowl area. The landing gear uses 450x500 tires with disc brakes. The front wheel uses a fork from a mountain bike with a new fork bottom made to fit the 450x500 wheel and tire. It will have a bungee system.

The airfoil has recurved or upswept trailing edge. Elevators and ailerons will be attached to the rear spar and there will be separate control wing tip rudders. The pilot and fuel are located on the CG, with wing tanks so no fuel is carried in the cockpit.

Empty weight is 300 lbs., wing span 30', with a chord of 72".

If anyone would like more information write to this address, sending a SASE for a reply or call (615) 562-4319 (EST).

Eugene Watson
Route 2 Box 824
Caryville, TN 37714



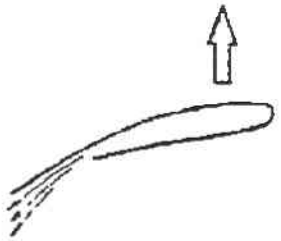
LEFT: Three-view of the low-wing radio controlled model currently being flown. Full size will be built some time in the future.

RIGID WING READER & ULTRALIGHT SAILPLANE NEWS

A newsletter dedicated to providing a united voice in further developing the rigid-wing industry, a certification program, and satisfying the self-regulation imperative.

Subscription Rate:
$24 (US) per year
Back Issues: $2 (US) each issue
Postal or international money orders only
Make payable to: Chuck McGill

For more information contact:
Chuck McGill
P.O. Box 464
Olympia, WA 98507-0464
Internet at: rwr-usn@win.com



THE HIAM AIRPLANE NEEDS YOUR HELP

For those interested in assisting Budd Love with the future development of his High Internal Air Mass (HIAM) project, he would be glad to hear from you. This concept has some potential to include design of a Horten type flying wing utilizing HIAM technology. (See Dec '92 newsletter, page 4.)

Contact: AIRLOVE, LTD.
6423 Campina Place
La Jolla CA 92037
(619) 459-1489

BELOW: This is a drawing by Larry Watson of a proposed new version of the ARUP Flying Pancake. It seems there are a lot of people out there becoming interested in this type of design. Is it because of its flying qualities, ease of construction, or just because it looks different from other "flying machines."