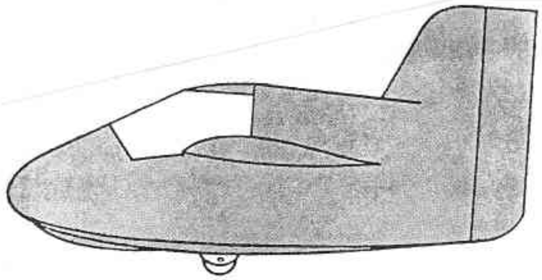
No. 81 MARCH 1993

T.W.I.T.T. NEWSLETTER



"Why The Dingus?" A small, all-wood tailless sailplane proposal by Dennis Harmon and Larry Linville in the March 1972 issue of Soaring magazine. We are asking "Where's The Dingus?" See more on page 6.

GENERAL CHARACTERISTICS

Specific Use: Research, Sport.

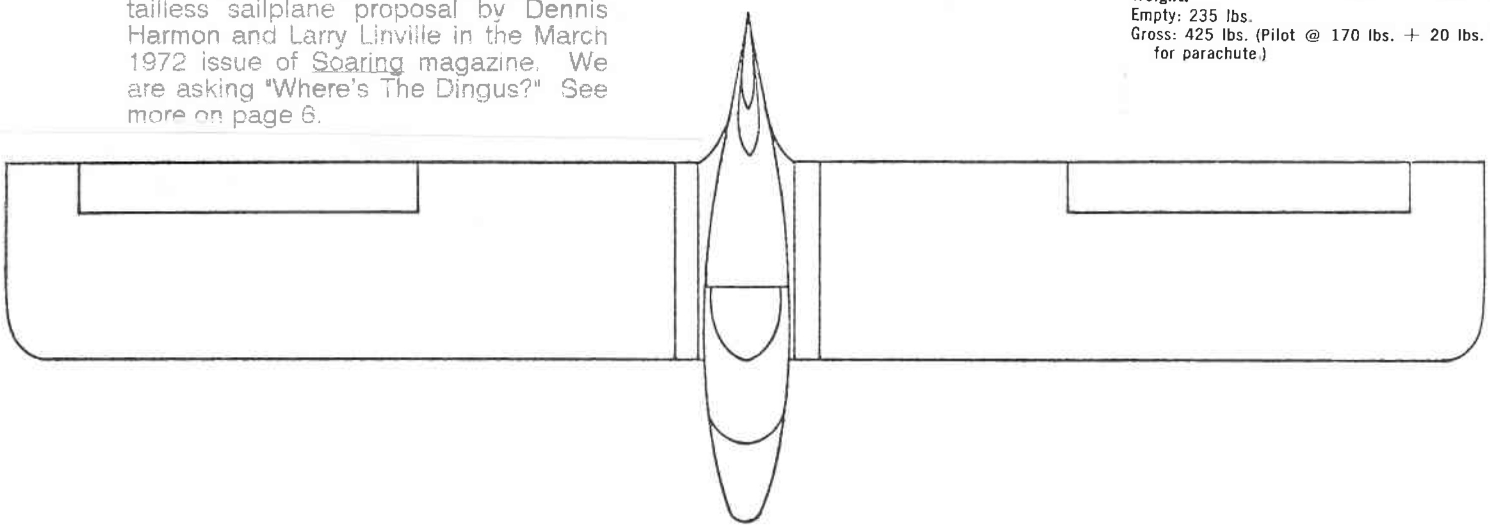
Fuselage:
Type of construction: Stressed skin.
Basic structural material: Wood.
Skin material: Plywood.
Nose tip: GRP, balsa, or foam.

Wing:
Construction: Cantilever, 2 piece with carry-through.
Planform: Rectangular.
Location: Shoulder height.
Airfoil: 8-H-15
Aspect Ratio: 7.625
Area: 118 ft. sq.
High lift devices: None.
Wing loading: 3.6 lbs./ft.^{2}
Spar material: Spruce, box-type, laminated caps.
Skin material: Plywood—no fabric.
Dihedral: None.

Cockpit:
Controls: Stick.
Instruments: Nominal.
Canopy: Blown or flat wrapped plexiglas.
Visibility: Good.

Landing gear:
Type: Single wheel, fixed, with skid.

Weight:
Empty: 235 lbs.
Gross: 425 lbs. (Pilot @ 170 lbs. + 20 lbs. for parachute.)



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., **9303** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, March 20, 1993, beginning at 1330 hrs at hanger A-4, Gillespie Field, El Cajon, Calif. (First hanger row on Joe Crosson Drive - East side of Gillespie.).

TWITT

THE WING IS THE THING

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 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

IN MEMORY OF: DON MITCHELL

We are sad to announce that Don Mitchell past away the middle of last month (February). To the best of our knowledge, his memorial service was kept very private and there has been no indication of any last wishes he may have had for contributions to a worthy cause.

The world of flying wings (tailless flight) has suffered a great loss by the passing of Don. He has been a stanch proponent of the flying wing concept since before WW II, and has contributed many designs, both commercially and for sport aviation over the years. His Mitchell Wing hang-glider help revolutionize that movement with a higher performance and safe aircraft that many still use today. It is through these aircraft that Don's memory will live on for future generations.

As for other business, I need to **remind our foreign members that as of March 1, 1993, the subscription rate for the newsletter was increased to $22 US.** This was done reluctantly, but was necessary due mainly to increasing postage costs.

For some unknown reason we had virtually no letters this past month. Don't forget, this organization and the newsletter are only as good as the material we can share with each other. The library has a finite amount of material that is suitable for general publication. Thanks to Bob Chase and Bud Mears we have some new things that will keep it filled for the next couple of months.

If you are working on winter projects, take a few photos and write us a brief description of your progress. Tell us about your problems and how you solved them so others won't have to go through the same discoveries.

I hope we will begin hearing from more of you, but until then that's it for this month.

Andy

MARCH 1993 PROGRAM

Our speaker for this month will be Ray Cote, a world renown Formula One racing pilot. He will be talking about flying the Ryan Cloudster to the EAA Fly-in at Oshkosh, while setting a world motor-glider record for distance. He started from El Mirage, CA, with 32 gallons of gas to cover the 1700 mile journey. He arrived at Oshkosh with enough fuel to also fly the efficiency course before breaking the seals that Bob Fronius (TWITT founder) placed on the tanks in California.

Ray is the only race pilot in America with a dozen sanctioned air racing championships to his credit. His final win was at the Reno Air Races in 1989, beating out seven other competitors at an average speed of 230.25 mph.

He has had a distinguished career as a Naval Aviator, flight instructor, sky writer, and freight pilot, before retiring as Teledyne Ryan Aeronautical's Chief Pilot and Flight Service Manager.

Bob has arranged for Garry Gramman to bring in his Mooney Mite for our hardware segment. This aircraft was built in 1949, purchased by Garry in 1950 from Southern Cal Aeromotive, and been in his loving care ever since.

Since Ray is on-call for charter work, if he cannot make it at the last moment, we are planning a substitute presentation. This will be a slide show prepared by Bob Fronius and narrated using the audio tape of Don Mitchell's presentation at the 1991 SHA Workshop in Tehachapi. Although we published his general comments, many of our local members have not heard this informative talk by Don, so even the alternate program should be of interest to many.

MINUTES OF THE FEBRUARY 20, 1993 MEETING

Andy opened the meeting by welcoming everyone to what was really the first full meeting of 1993.

After getting some of the routine housekeeping items out of the way, he announced that the raffle prize for the day would be an Aviation Pioneers stamp collection set and historical book.

Bruce Carmichael thanked TWITT for the sympathy card and flowers sent to Georgie's memorial service. They, and the thought, were very much appreciated.

June Wiberg reported that Don Mitchell was doing better, and Bruce Carmichael indicated he had heard Don was completely off the supplemental oxygen and sitting up. *(See this month's President's Corner for more.)*

Bob Chase had brought along three magazine articles he thought might be of interest to the membership if we could get permission to publish some of the information. (Two have been treated later in this newsletter, and the third was "Fly the Wing", by Miles McCallum, in the February 1993 issue of Kitplanes, Vol. 10, No. 2, pp. 73-77. It covers Reimar Horton's PUL 10, and will be reviewed in a subsequent newsletter. We originally thought this might be an English translation of the French article sent to us by Gunthar Rudat, however, closer scrutiny show this not to be the case.)

Andy introduced Grahame Fleming who asked to make a brief announcement about an Aerobatic Contest at Borrego on March 25-26. This year they are inviting gliders to compete, and so far have four coming in from Arizona. Grahame also provided us a tape showing the initial test flights of an ultra-light version of the Arup flying wing style aircraft (flying pancake). The aircraft appeared to fly very well and the reaction from the pilot and observers indicated they were very pleased with the performance.

A short video provided by Don Woodward on a successful model ornithopter was shown. Although it was quite noisy, it was controllable and able to sustain itself in flight. The designer and builders were shown during TV interview, at which time they unveiled a larger, more sophisticated version of the model that would be flown at the 1992 World Expo in Spain.

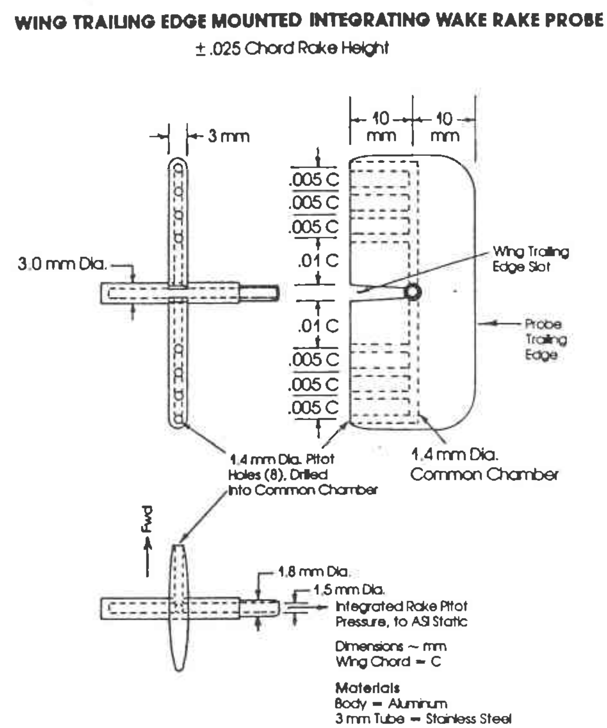
(Ed. Note: Bud Mears gave out some very technical information about how this measurement system works and provided a number of formulas that prove each of the hypothesis'. He also provided copies of these formulas and many of the resultant graphs from his testing which have not been published with these minutes. For those of you interested in the total technical discussion, we will be glad to send you a copy of the audio tape and supporting paperwork at a cost of $5.00.)

Andy then introduced our main speaker for the day, Bud Mears. Bud began by explaining he got started in the 1980s with flight testing using an integrated drag rake to find the best flap settings for various flight speeds. His tests were based on the earlier work of Dick Johnson as published in Soaring magazine. (Bud provided a copy of the 1983 article for the TWITT library for those who don't have access to Soaring. He also contributed a concept, construction and flight test article on the SB 13 project, which eventually find its way into the newsletter.)

Bud went through a lot of technical formulas to show how glider pilots try to overcome Drag Reduction Paranoia. This equates to: reduce drag and increase weight to reduce sinking speed, and; the heavier of two aerodynamically identical gliders has more potential energy and can deliver the power required at a lower sinking speed. This discussion is not covered in detail since it was simply laying the ground work for why you want a heavier aircraft with a lower drag.

The drag rake provides relative data which is sufficient for most purposes of the average glider pilot. Figure 1 is a diagram of a typical drag rake made out of aluminum. Buds rake had been made out of lucite type plastic with the common chamber drilled straight through then plugged at the ends. The pitot holes were then drilled into the common chamber at the required intervals. The cross tube was epoxied into position to transfer the pressure to the Kollsman airspeed indicator (ASI) static connection.

Figure 1



The rake is mounted on the trailing edge of the wing at the point used to determine the chord relationship dimensions as shown in Fig. 1. These are meant to capture the boundary layer and some free stream air movement without getting an excessive amount of the later.

Bud's initial tests backed into positioning the rake on his wing by computing where Dick Johnson's existing rake would match the dimensions. The pressure transfer tubing is taped along the trailing edge or run along other slots, e.g. flap gaps, etc., into the fuselage.

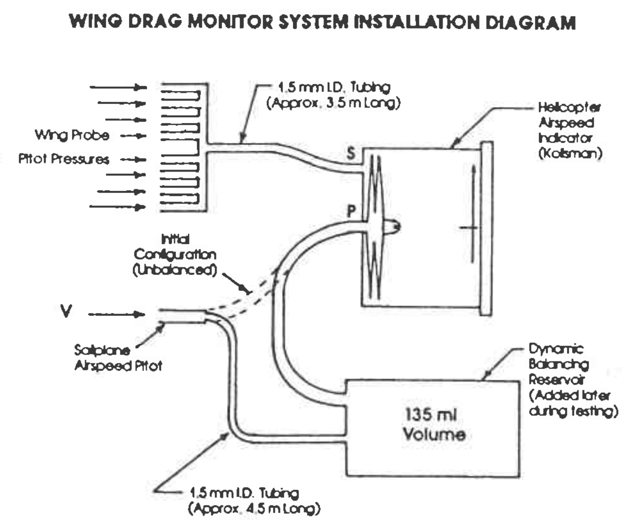
The proportions of the rake are designed to provide an average pressure of all the readings from the tubes. Some tubes have air moving into the common chamber representing full ram pressure, while other tubes may have air moving outward, depending on the degree of turbulence or laminar flow in the wake.

The pressure tube is hooked up to the static side of a standard ASI. The aircraft's normal airspeed system taped and hooked to the pitot side. The resultant indicated airspeed represents the difference between free stream ram pressure and average pressure within all of the rake, and since drag reduces the internal pressure you will always get a positive reading. The lower the airspeed reading the lower the drag.

As the aircraft descends, the static pressures change causing a lag in the readings provided by the ASI. This is overcome by the addition of canister that is adjusted to equalize the volume between the normal ram system and that of the rake tubing and ASI. (See Figure 2.)

This volume can be easily tested prior to flight. Roll up the amount of tubing it took to get from the rake to the ASI, duplicate that amount for the pitot system, then place the rolled up pitot tubing in a container of about equal size. Hook up the system through the lid of the container, and make another opening where you can then blow or suck air. This should cause movement on the ASI and the degree of lag can be determined. Adjusting the volume will fine tune the system to eliminate the lag. Bud used common PVC pipe and end caps to create a container and gradually cut away the tube to reach the volume he needed.

Figure 2



He briefly discussed the effects of free-stream static sources and their impact on the results. He wasn't concerned about the imperfections in his system since the errors in the static system were affecting both the rake ASI and the aircraft's normal ASI, which is used for making the drag comparisons. You can use other types of linear indicators with the rake, but as it turns out the ASI method seems to work best since there are no conversion calculations needed to make the final data comparisons.

Bud also went into an overview of how the proportions of the rake were determined in relation to the size of the boundary layer. He did this analysis to see what size rake was needed to perform tests on the tail surfaces which have a narrower chord. He did find you can make a rake that is to large, thus measuring too much of the free stream flow and biasing the results.

Bud Mears explaining one of his graphs.

He then presented the initial data curves he plotted on his LS-3a in 1988. Plots were made for -7, 0, +5, and +10 degrees flaps using the indicated mph on the horizontal and the rake speed on the vertical axis. What he was looking for was any cross over points on the curves to determine at what airspeed to make configuration changes to reduce the resultant drag. For his particular ship (and everyone is different) he got a point at 85 mph where the graph showed he needed to put in -7 degrees flap as acceleration continued. With this setting his drag was the same at 100 mph as if would have been with 0 flaps at about 91 mph. (See page 5 graph.)

Bud also ran some test data while circling in a turbulent thermal and found that, here too, there was a cross over point on flap settings which would give the lowest profile drag for an indicated airspeed.

Bud eventually sold his LS-3a and bought an LS-4a, standard class sailplane. This does not have flaps, but was designed to use turbulators on the underside of the wing to eliminate the laminar separation bubble. He initially flew it without the turbulator, using the rake, and found that he could get rid of the separation by accelerating through it and then slowing down without reacquiring the bubble. (See Figure 3.)

He then made his own turbulator test strip using dymo tape with a series of periods impressed into it. This was found to be a suitable substitute for the more expensive material recommended by the sailplane manufacturer. He mounted it on the bottom surface about 2/3 of the way back from the leading edge, centered in front of the rake.

Having already flown a baseline flight without the turbulator, he went back up to fly a new profile. He was looking for high-speed results, but was surprised to find that the best gains were in the low-speed end which would help with circling flight. All this occurred without any significant increase in drag. It was giving him the equivalent of about 4-5 degrees of flaps during slower flight. It also did improve the high-speed end as he had anticipated, which allowed him to achieve higher performance.

Bud closed his presentation with a brief discussion on the effects of carrying heavy loads of water, in the wings, on the trim loads of the tail. He plans, sometime in the future, to go through a series of tests using the rake simultaneously on both the wing and tail surfaces, with and without water loads, including some in the tail, to determine if there are any changes that need to be made.

There was a general question and answer session between the audience and Bud, unfortunately the tape recorder malfunctioned and some of this material was lost for transcription purposes.

The raffle prize was won by Bob Chase, proving that buying in volume often produces a better chance of winning. (Why doesn't this work when buying lotto tickets???)

Andy then adjourned the meeting.

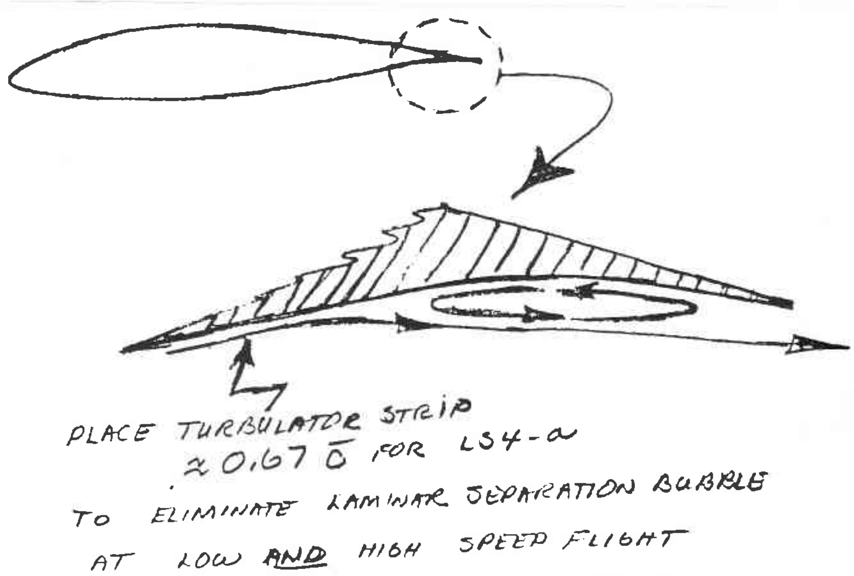
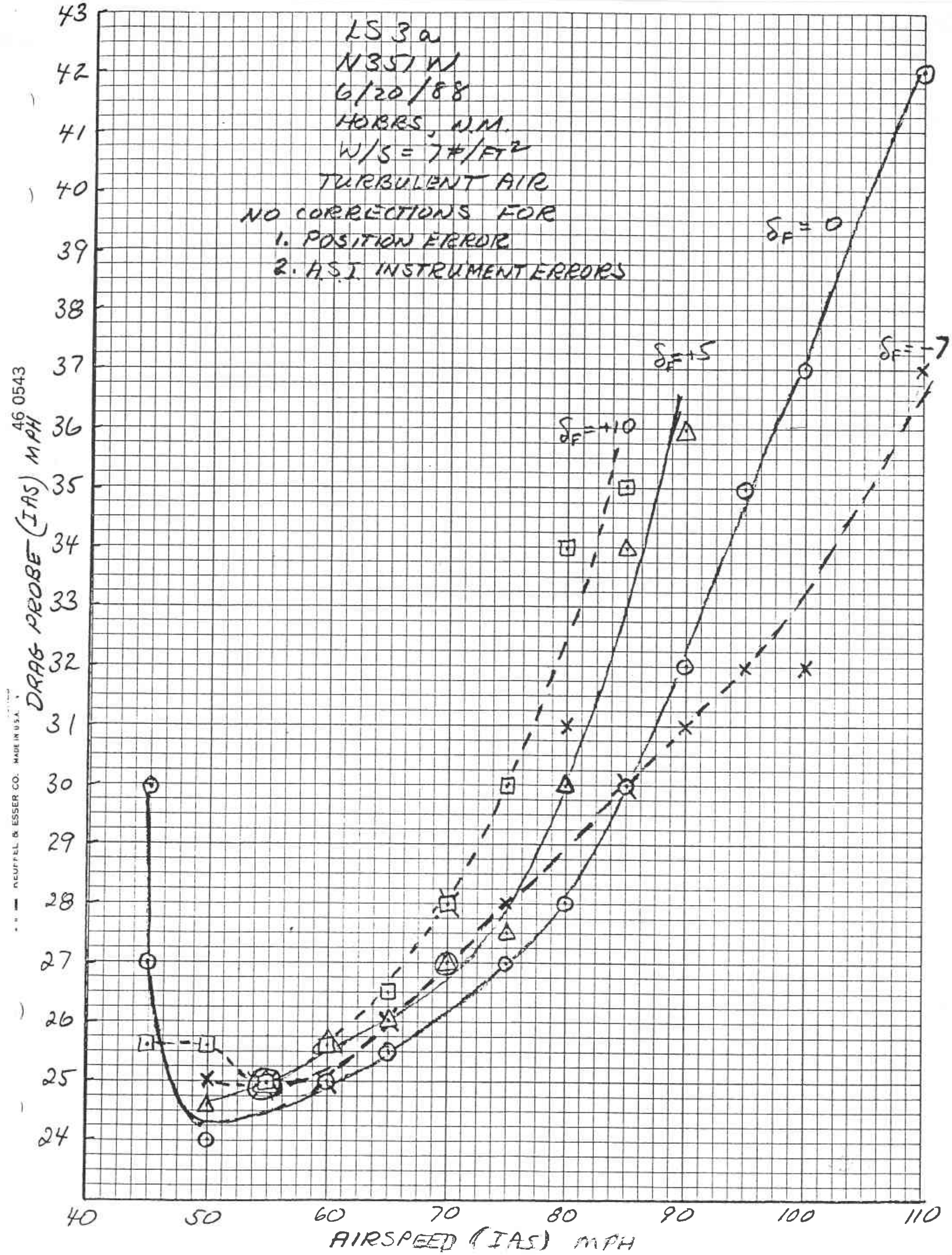


Figure 3.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LETTERS TO THE EDITOR

2/23/93

TWITT

Enclosed is my renewal and a little extra for whatever the group needs.

I wonder if I might ask the membership for some help expanding a section of my tailless aircraft bibliography. Since the thing continues to grow, I suspect that there will be future incarnations, and I'd like to increase the scope of the section on sources of rare or hard-to-get information. It contains entries ranging from the Smithsonian, A.I.A.A., and N.T.I.S. down to sources of plans and special library collections (of course TWITT is included). I'd appreciate hearing from members about other favored sources of especially relevant information, collections, or displays. What's in the San Diego museum, for instance?

Thanks to everyone for their help.

Sincerely,

Serge Krauss
3114 Edgehill Rd.
Cleveland Hts, OH 44118
(216) 321-5743

(Ed. Note: Thanks for the renew and the extra for some of the miscellaneous expenses we always seem to incur.

Hopefully, you will hear from the members to help you fill in some of the blanks. If you don't hear from Ed Leiser, directly, you might want to contact him (see roster). He is the San Diego Aerospace Museum Curator and receives a copy of this newsletter each month. He has spoken to our group in the past, and contributed some historical material on a number of different aviation subjects.

I ask our members to support Serge's efforts, since he has put together an excellent bibliography of tailless material from around the world.)

A LOOK AT THE PAST

As mentioned in the minutes, Bob Chase had found an article in the March 1972 Soaring magazine titled "Why the Dingus?", by Dennis Harmon and Larry Linville (Vol. 36, No. 3, pp. 30-31). A better question at this time might be "Where Is The Dingus?"

The following information on the Dingus was extracted from the article and is offered as an enticement to someone out there to maybe find out more about what happened to this project.

"The Dingus is a small, all-wood, tailless sailplane in an advanced design stage. Its primary purpose is that of an experimental research vehicle to be used in determining just how good the tailless configuration is compared to conventional sailplanes. It will also be used as a flying test be to conduct various tailless-oriented aerodynamic experiments."

"Starting with the EPB-1C Flying Plank as a point of departure, we began the project as a series of simple modifications that would give us what we wanted. Namely, an increase in directional stability, an increase in span/area/AR, and detachable wings. The only vestiges of the Flying Plank that remain are a vague similarity in pod formers and, to a degree, the control mixer."

"The airfoil is what Dennis calls the 8-H-15, and is laminar. It was created by extracting the basic thickness form and mean line from the NACA 8-H-12, increasing the thickness of the basic thickness form to 15%, then combining the 15% thickness form with the 8-H-12 mean line--a new airfoil."

"The airfoil does have a peculiarity, as its drag coefficient increases sharply above 75 mph, where the profile leaves its low drag bucket."

"As many people have already expressed any interest in building a Dingus, and as it will hopefully lend itself to modestly filling the requirements of various segments of the soaring fraternity, we intend to provide a comprehensive and detailed set of plans and construction notes, but only after the initial flight tests are satisfactorily completed."

"We have toyed with the idea of interesting prospective and technically qualified Dingus builders in building variants. For instance, one might try the Wortmann FX 05-H-126 airfoil, another the Eppler 620 series, yet another the 15-H-15, etc. Then again, we have tapered wings, tapered outer panels, swept forward wings, swept rearward wings, and for the very brave soul, in-flight variable sweep wings."

"However, all this still lies in the future. Why the Dingus? . . . Indeed, why not?"

THE ELEMENTS OF TAILLESS AIRPLANE DESIGN

by A.A. Backstrom

(Ed. Note: This article appeared in Sport Aviation, May 1979, Vol. 28, No. 5, pp. 39-44, and is being printed with the permission of the original author, Al Backstrom, a member of TWITT. It was brought to our attention by Bob Chase, who thought it might be a good foundation for many of our newer members. Due to its length, we will publish it in two segments so other material can also be included in each month's newsletter.)

By A. A. Backstrom

THERE HAS BEEN over the years a tendency to classify tailless airplane design as an area of mystique practiced by persons very adept in the manipulation of Ouija boards. The people using these guidelines seem to be able to overlook the well-engineered airplanes that have shown good flight characteristics. Several of these have been certificated by the country of origin or used operationally by their military units. After we have discussed the design problems, I will present some information on designs worthy of further development.

The first decision in tailless airplane design is: WHY? To answer that question let's tabulate the primary advantages and disadvantages.

Goodies

1. Reduced drag
2. Reduced weight
3. Simpler structure (possible)

Discussion

The advantage of tailless airplanes is that for an equivalent payload, a lighter airplane requiring less power and fuel can be designed.

The CG range can be greatly extended by using low aspect ratio as in the Delta or Hoffman types. These are not normally suited to small airplanes because of the high power requirements at climb speed.

Baddies

1. Reduced CG range
2. Limited use of high lift devices

Discussion

The small CG range will kill off mid-sized airplanes. To obtain a usable design the variable weights must be very small or the airplane large so the weights can be distributed spanwise near the CG. To be blunt about it, don't try to design a Cherokee Six equivalent. The limited use of high lift devices makes achieving a large speed range difficult.

Well, if the goodies outweigh the baddies to you, let's go on and look at small tailless airplane design considerations point-by-point. (I assume that if you want a very large tailless airplane you will get your own Ouija board.)

Wing Configuration

As in any other airplane, the wings may be straight, swept back, or swept forward with various combinations of taper and twist. Determine wing sweep at the .25 chord line. Figure 1 illustrates these layouts and the re-

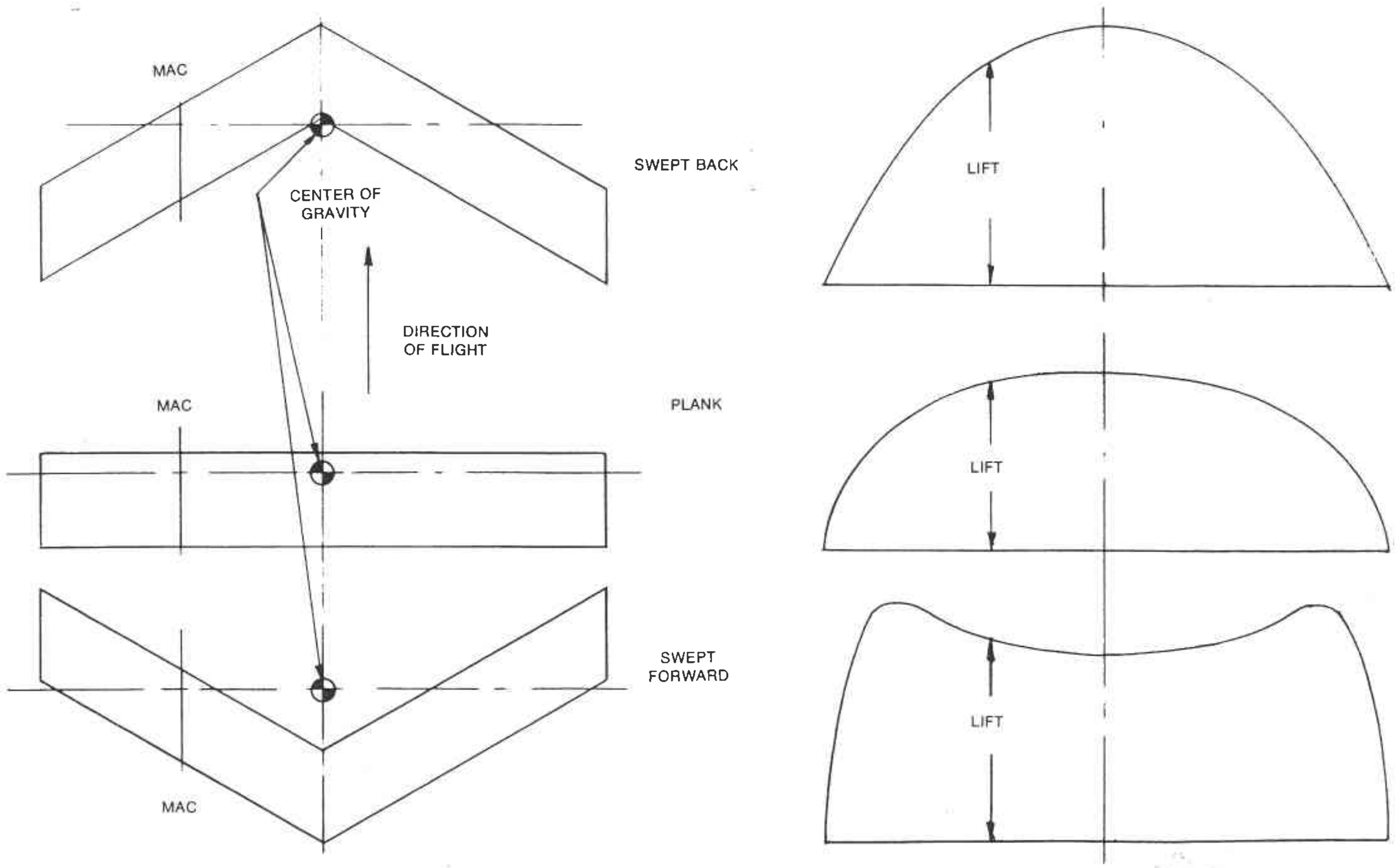


FIGURE 1
STABLE WING SYSTEMS & THEIR LIFT DISTRIBUTIONS

quired wing lift distributions. Of special interest is the swept forward configuration. I do not recommend trying the swept forward layout due to the highly loaded tips and the fact that they must either stall first or be prevented from ever stalling. Of course, for satisfactory flight characteristics the tips cannot be allowed to stall first. Some NACA Wartime Reports show the proposed Cornelius glider tanker to be about the worst of the tailless designs tested. A small amount of sweep forward to produce a straight leading edge, as used by Jim Marske, can produce good results.

So this leaves us with straight and swept back. The determination of which to use will depend on the CG travel required. Put simply, the more CG travel that must be tolerated, the more sweep required. Figure 2 shows an in-work auxillary powered plank sailplane design intended for almost zero CG travel regardless of weight changes. You may ask why work for small CG travel if it could be controlled by incorporating sweep. Well, the opposite problem is that the smaller the sweep angle the better the performance should be.

will depend on whether the airfoil (or wing system for swept types) has a nose up (+) or nose down (−) pitching moment coefficient. Also, the stability is directly tied to the CG location. Figure 6 shows the stability build up of the components of a conventional airplane and the effect of CG location. I hope you can review these figures and see that once you establish an airplane configuration, the location of the CG relative to the neutral point determines the static longitudinal stability.

Harry's numbers in Figure 6 are approximate, but they will serve to illustrate that a tailless design will have the neutral point well forward of a tailed type. On a wing alone the neutral point is approximately 25% mean aerodynamic chord (MAC). The addition of a pod as required for small machines will shift this slightly.

There is one other factor to be considered in design and that is protection of the rear CG limit. The tailless airplane should be designed so that in normal loading it will be very difficult to load the airplane aft of the established rear CG limit. This is because the range be-

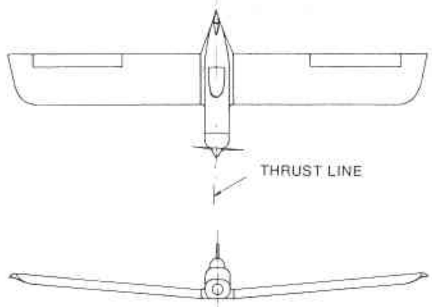
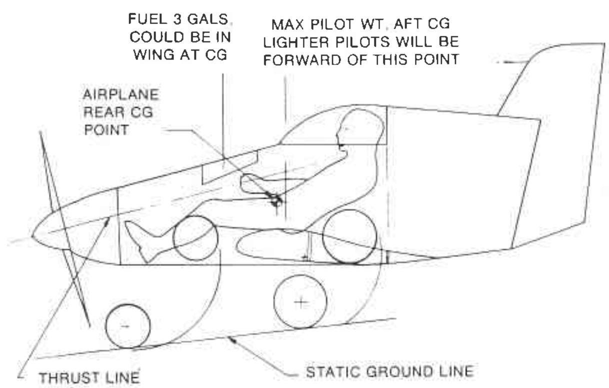


FIGURE 2
PLANK CONFIGURATION DESIGNED FOR
MINIMUM CG TRAVEL



Longitudinal Stability and CG Location

Understanding longitudinal stability in airplanes provokes one of my pet peeves. I have heard the following statement thousands of times: "I know why a conventional airplane is stable, but I don't understand why yours is." Now really, if you understand one, you understand the other. To help all these people understand why airplanes are or are not longitudinally stable, let's take a quickie course on the subject using figures from Harry Hurt's excellent book, **Aerodynamics For Naval Aviators.** In these figures, Cm is pitching moment coefficient of the entire airplane, Cmac is pitching moment coefficient of the wing about the aerodynamic center, appproximately 25% chord at subsonic speeds. The sign convention is + for nose (or leading edge) up. Cl is lift coefficient, and increased Cl at fixed weight means lower speed or higher load factor.

Figure 3A shows characteristics of a Cm vs Cl curve for a typical stable airplane. Stick fixed it will trim at the point marked Cm = O and when the airplane is displaced from this Cl it will tend to return to the Cm = O point. Figure 3B shows the other possible stability conditions and that the stability is directly proportional to the slope of the curve. Ordinarily the static longitudinal stability does not change with Cl except in the range where Cl Vs angle of attack is no longer linear. Figure 3C shows a possible condition with changes due to power effect, high lift devices, wing location, etc.

Figures 4 and 5 show what a wing alone can contribute to longitudinal stability. You will note that a wing alone can be stable or unstable and that the trim point

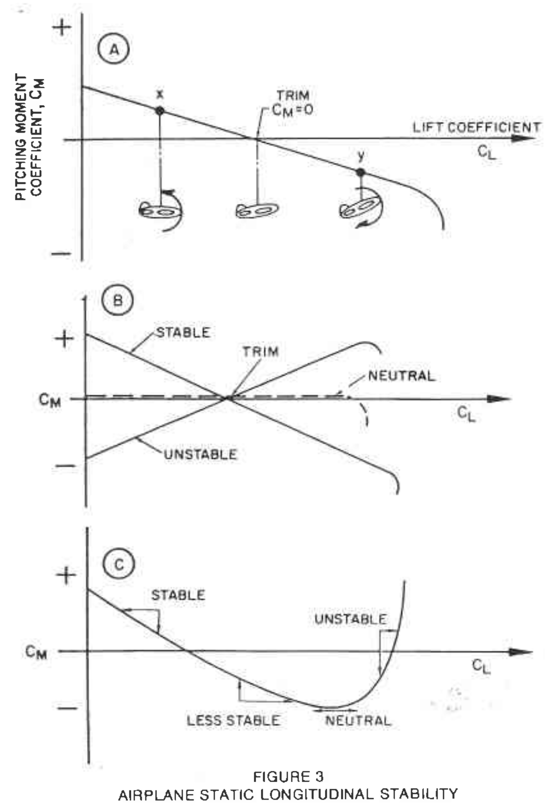
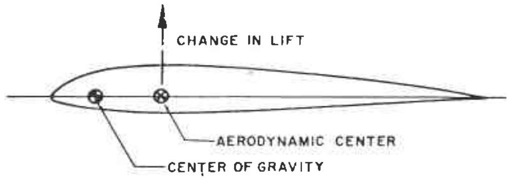


FIGURE 3
AIRPLANE STATIC LONGITUDINAL STABILITY



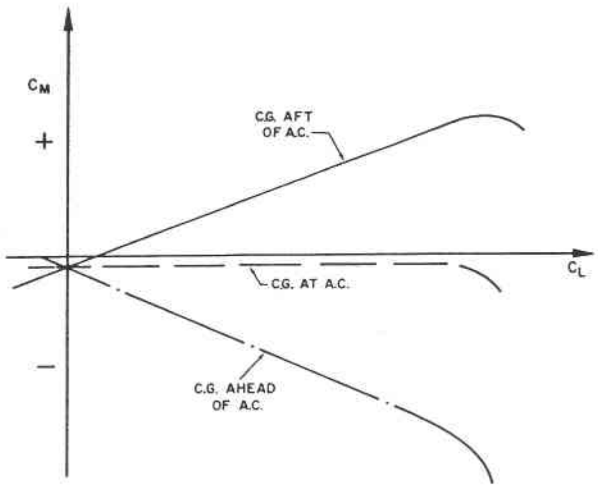


FIGURE 4
WING CONTRIBUTION

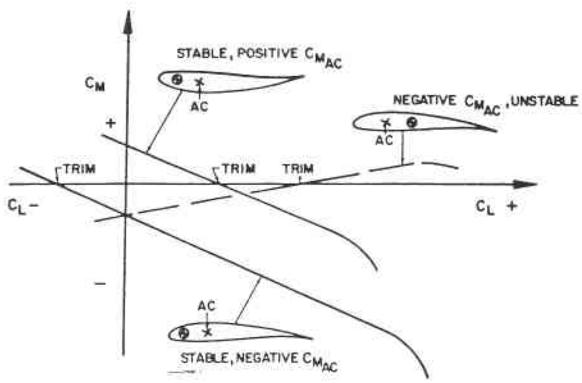


FIGURE 5
EFFECT OF CMAC, C.G. POSITION

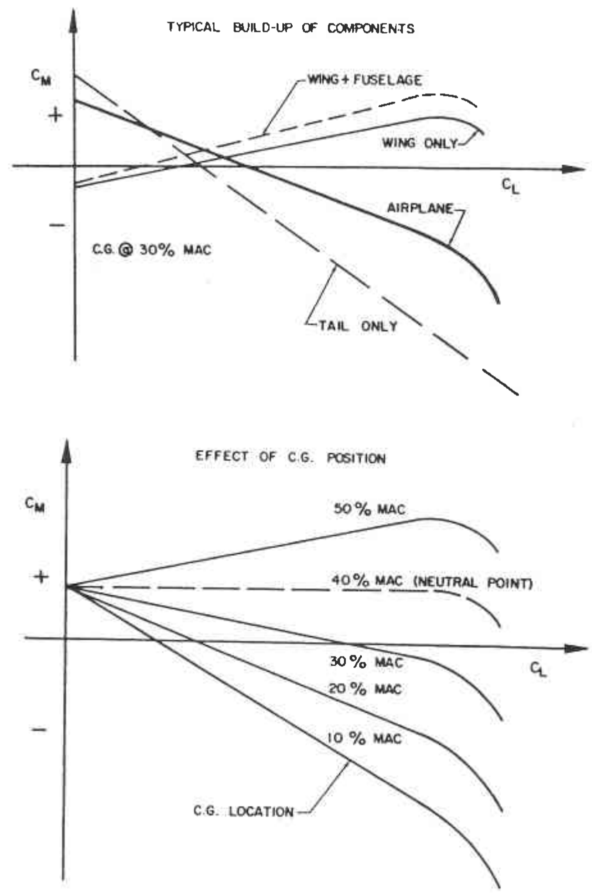


FIGURE 6
STABILITY BUILD-UP AND EFFECT OF C.G. POSITION

tween unstable and unflyable is smaller than a tailed type.

Well, now to the final point — where to put the CG (you thought I would never get there, didn't you!). On my flying planks we have used from 15 to 22 percent MAC. The range forward of about 18% results in large elevon deflection and high trim drag. So for a new design, use about 20% MAC to start with and work forward and back slowly to determine what the design can handle. You can refer to most aerodynamics text books for ways to determine MAC.

This was more discussion than I intended, but I hope it has helped you understand the basic principles of static longitudinal stability.

Directional Stability

Most of the reports of poor flight characteristics I have heard of in tailless airplanes are the result of poor directional stability. It seems that some designers, aiming at drag reduction, lose sight of the fact that it won't fly right if it doesn't go in a straight line. The solution to the problem is simply to have enough vertical surface far enough aft to accomplish this. On a swept wing you might use a diffuser tip as shown in Figure 7 rather than tip fins. You should note that both the bend down and the canting of the break line are required for a diffuser tip.

The roll your own section will provide you with information on how to find out how much area, etc.

Aerodynamic Controls

In selection of design for aerodynamic controls, you should try and select types that will produce a minimum of adverse secondary effects. You may refer to the drawings of successful designs for some information on proportion.

I personally favor wing tip elevons for pitch and roll control because they will build in additional wash out in the tip area at low speed which will help prevent tip stalling and increase spin resistance. On straight wing designs with pusher engines tip fins and drag rudders should be used. With a straight wing tractor a single fin on the aft pod can be used if it is far enough aft. Don't copy the EPB-1c in the EAA Museum because the arm is too short; it was done that way to keep the sailplane trailerable. If you have a similar design problem you should use a fixed fin and drag rudders at the wing tip. The drag rudders may be like Jim Marske's XM-1D or a flap on the upper surface only with the lower surface fixed (similar to that shown in Figure 7 or the plank modification shown in **Soaring**, July 1972). On a swept wing design the diffuser tip with a drag flap rudder (see Figure 7) or a small vertical surface and outward moving rudder can be used. Drag flaps of this type on dif-

ODDS AND ENDS

We are pleased to announce that Bob Fronius has been selected as a scale judge for the 1st Annual Torrey Pines Radio Controlled Sailplane Championships, to be held on Saturday, March 20, 1993, at Torrey Pines Gliderport (where else?) beginning at 9:30 am.

He will be joining John Robinson, Victor Saudek and John Ludowitz to perform stand-off scale judging of RC models that represent actual full-scale sailplanes.

Bob will also participate as a judge for the full-scale event on Sunday, March 21st, when vintage and other types of gliders will be brought in for a dedication ceremony and soaring.

These activities on Saturday and Sunday might be of interest to our Southern California members, but don't forget to leave Saturday's model events in time to make the TWITT meeting.

AVAILABLE PLANS & REFERENCE MATERIAL

__Tailless Aircraft Bibliography__

by Serge Krauss

3rd Edition: An extensive collection of books, articles and other items related to the development of flying wing (tailless) aircraft design and construction.

Cost: $20
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 amatueur full size builders.

Published by B[2] Streamlines, P.O. Box 976, Olalla, WA 98359-0976, or (206) 857-7249 after 4pm Pacific Time. Price is $38, postage and handling included (also applies to Canada and Mexico). 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.

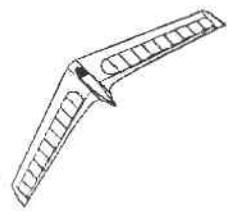
FLYING WING SAILPLANE PLANS AND KITS

Two time-proven, 13m homebuilt designs suitable for the novice pilot. Build either the MONARCH "F" ULTRALIGHT (19 to 1), or the PIONEER II-D (35 to 1) sailplane.

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

Marske Aircraft Corp.
975 Loire Valley Drive
Marion, OH 43302
(614) 389-6055

MODEL WINGS



Tower Hobbies carries the Future Flight Klingberg Wing kit for $39.99 (item #TE1130) and the Klingberg Wing 100 for $149.99 (item #TE1131). They can be contacted at:

P.O. Box 9078
Champaign, IL 61826-9078
1-800-637-4989 or (217) 398-3636
Shipping: $5.75

They are also available from:

Omni Models
P.O. Box 708
Mahomet, IL 61853-0708
1-800-342-6464 or (217) 398-7738

Klingberg Wing (FFTA1000)	42.99
Klingberg Wing 100 (FFTA1105)	144.99

Shipping: $5.00

SAILPLANE HOMEBUILDERS ASSOCIATION

The purpose of SHA is to foster progress in sailplane design and construction which will produce the highest return in performance and safety for a given investment by the builder. They encourage innovation and builder cooperation as a means of achieving their goal.

Membership Dues:		
	U.S./Canada	$17 USD/yr
	Other Countries	$21 USD/yr
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(includes 12 issues of __SAILPLANE BUILDER__)

Make checks payable to: Sailplane Homebuilders Association, & mail to Secretary-Treasurer, 545 McCarty Drive, Furlong, PA 18925.

WANTED - 250 (1 Cyl) Zenoah parts, plus a 252 belt reducer with 4 belts. If you can help, contact:

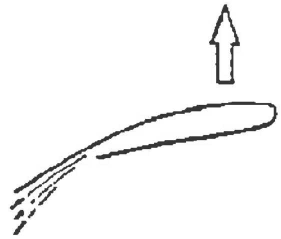
W. Ed Mux
1500 E. Main Street
Merrill, WI 54452
(715) 536-7404

FOR SALE - Consolidated booklet of the 3-views and specifications for all the SHA Design Contest aircraft. This is a nicely done newsletter style publication that gives you all the information in one place. Bob will also be including one issue of the TWITT Newsletter. (If you are a TWITT member, you might want to specify which issue of the newsletter you would like to avoid duplications.)

Cost: $4.00 US, Postage Prepaid

Contact: Bob Fronius
P.O. Box 20430
El Cajon, CA 92021

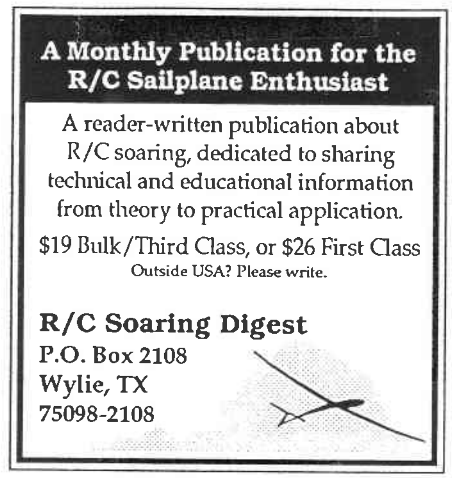
Doug Babb, from Point Mugu NAS, one of our newest members testing a more conventional design.

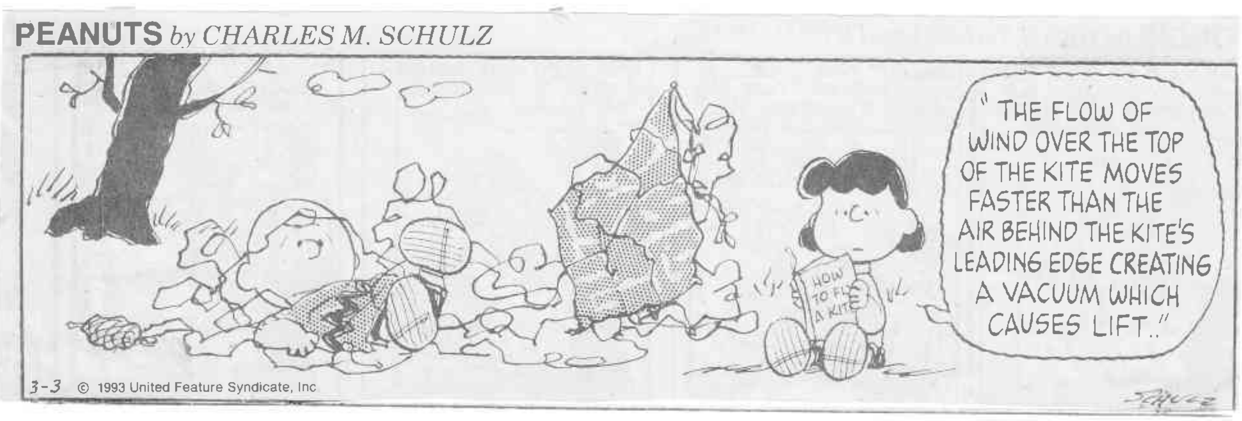


THE HIAM AIRPLANE
NEEDS YOUR HELP

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 changed in recent months 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





Hopefully, our members are having better luck with basic aerodynamics!!!!