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T.W.I.T.T. NEWSLETTER

Central fin version of EPB1-C. http://www.nurflugel.com/Nurflugel/Fauvel/plank_3.jpg

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

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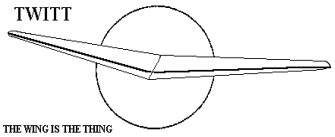

THE WING IS THE THING (T.W.I.T.T.)

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

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Meetings are held on the third Saturday of every other month (beginning with January), at 1:30 PM, at Hanger A-4, Gillespie Field, El Cajon, California (first row of hangers on the south end of Joe Crosson Drive (#1720), east side of Gillespie or Skid Row for those flying in).

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PRESIDENT'S CORNER

Sorry this is a little late and I don't have any good excuse except laziness it getting it done.

If you haven't read your February 2018 Soaring magazine, there is a nice biography on Don Mitchell as part of their Hall of Fame series on page 23. If you aren't a member of SSA, look up a friend who has a copy and give it a read.

That's it from me this month. I am waiting for the return of warmer weather here in central Texas so I can get back to flying as well as doing some outside work around the house.

LETTERS TO THE EDITOR

Hi Andy

I stumbled across TWITT while doing some online surfing about Fauvel flying wings. Currently, building a 1/4 scale model of the Fauvel 48, a prototype motor glider that I don't believe was ever actually built. Long time interest in aviation and weird shaped aircraft, especially wings.

Marine biologist (PhD) by profession, commercial diver, machinists and tinkering of mechanical things. Private pilot license, had a Bonanza for a number of years and a seaplane rating. We winter in Seal Beach when I build RC models. In April we move to our San Juan Island home where I have a complete machine shop and I build 1/8 scale steam locomotives and environmental sampling equipment. While on the island we also travel, boat, fish and enjoy living on the water in the NW.

Looking forward to reading about early Boeing flying wings. Being in the NW it is always fun to drop by the Museum of Flight at Boeing Field in Seattle. There is a lot of aviation history in the area but not much about wings.

Regards

Douglas Diener

(ed. - This is Douglas' reply to my welcoming letter when he joined. It will be interesting to see the final Fauvel 48 model when it is done.

I do need Douglas to let me know when he changes his seasonal mailing address so he doesn't miss any issues. I also offer to convert snail mail memberships to electronic for $10 a year for both foreign and domestic. One advantage is you see all the color images without having to go to the member's only section which is sometimes behind the paper version. Let me know by e-mail and I will adjust your current renewal date based on the $10 yearly rate.

Andy,

We received the newsletter earlier this month and saw our original email in an unfiltered format.. Interesting. I would have liked a response back and a chance to maybe make it more appealing to your readership. Please reiterate the following (in bold)

"I visited Al Bowers at NASA Ames earlier in the month. His knowledge has enabled me to see past some of the product development issues we were having at Zagi and helped me to understand the flying wing to a much greater degree. It turns out the NASA/Prandtl wing doesn't do really well in acrobatic situations especially inverted or at a high angle of attack. We are hoping to introduce a thermal glider to make the work of Al Bowers available to the general public. I have a slew of eager Beta testers waiting to get their hands on one and will report back as to how it works out!"

I am also the Secretary of our local EAA (#1544 Treeport, ID) and did some asking around about wings among the group. Turns out one of the guys worked on the B2 program and is very eager to help with anything flying wing related. Next step is to find or develop a design that is dependable.. Horten wings always come up first but I want a two and it needs to be very straightforward. Looking around I can't find anyone that has such a beast. Know of any?

Thank you for keeping TWITT alive!

Josh
Zagi LLC
<zagi@zagi.com>

(ed. - We have to thank Al Bowers for providing help on this project since it appears his suggestions will assist Josh in refining his wing models. If you have any comments or questions you contact him for, please include TWITT in your address line so we can share it with other members.)

(ed. - The following pages are an November 15, 1956, paper titled "Evaluation of the First Blank Performance Measurements" by A.A. Backstrom, Aerophysics Department, Mississippi State Collage.

I am sure we have published some of it in the past and this time it doesn't include the cited figures that I will include next month.)

Evaluation Of The First Plank Performance Measurements

By

A. A. Backstrom
Aerophysics Department
Mississippi State College

The development process of a sailplane is basically a series of steps. The first of these being design and construction of a prototype, then flying, and redesigning if necessary. If this work leads to reasonable results there is a great tendency to stop there. It is a shame to see so many potentially exceptional sailplanes stopped at this point. In this paper I am presenting an illustrative example of how to proceed beyond the prototype with the development of a sailplane.

In order to obtain the information required to guide the modifications, a careful series of flight measurements should be made. The first tests to be done are the sinking speed measurements which will yield the aerodynamic characteristics of the sailplane. Then subsequent studies should be made in order to determine the characteristics of the flow on the sailplane. This flow information should serve as a guide in modification.

The performance flight tests of the Plank (Ref. 1) were conducted late in October with Jock Powell as the research pilot. These tests included both rate of sink tests and tuft studies. The condition of the ship was the same as when it was at this year's, 1956, national meet.

The rate of sink, and L/D, vs airspeed curves (Fig. 1) reveal that although the ship was rather good in the mid-speed range, around 60 MPH,

the performance fell off both above and below this range. The curve of C_L^2 vs C_D (Fig. 2) was then plotted to analyze this behavior. From this curve it was seen that the actual airplane curve (solid line) was deviating from the theoretical curve (dotted line). The slope of C_L^2 vs C_D is a function of span efficiency factor and from this it can be seen that the span efficiency is being reduced in the low speed, high C_L, range. Also it should be noted that the drag is increasing in the high speed range. The average span efficiency factor is also seen to be 75% which is much lower than that which can be anticipated with a clean wing fuselage intersection. Also the maximum lift coefficient was found to be 0.75 when it should have been approximately 1.0. These factors point out that there are several things wrong but give no indication as to what.

A series of tuft studies were then made to determine the causes of these deficiencies. The low speed photograph (Fig. 3) reveals that there is a very large area of separation in the area of the wing center section. This area is seen to begin just forward of the bubble and to fan out at approximately 45° to the line of flight. The high speed photograph (Fig. 4) shows that there is still separation over the aft section of the bubble and the intersection of the bubble and wing. A photograph of the bottom of the ship is not presented but there was an area of separation similar to that on top in the wing-pod intersection occurring at high speeds.

The separation on the upper surface will have its largest effect in the low speed range since it will reduce the lift and span efficiency factor. The separation in the lower surface intersection will reduce

the high speed performance as it represents an increase in drag. No tufts were used on the bottom of the pod but an area of separation is expected aft of the wheel. Also it was found that the forward part of the tip fins were ineffective.

An area of separation has a large increase in drag, and a loss of lift if on the wing. It is now necessary to study the causes of separation. Separation is caused by a highly adverse pressure gradient and is aggravated by surface irregularities ahead of the separation area. This fact indicates that it should be possible to exercise a large degree of control on these areas of separation by the use of geometric boundary layer control. (Ref. 2). The requirements for the optimum use of geometric boundary layer control demands smooth transistions, not only in the flow direction, but also normal to the flow. In "Aerodynamic Drag", Hoerner (Ref. 3) points out that properly designed fillets can reduce the interference drag of an intersection to about 10% of its former value. Hoerner also states that the optimum fillet radius is from 4 to 8% of the chord and that the best effect will be obtained by extending the fillet aft of the intersection.

The use of this information should now allow a prediction of how modifications may be made which will allow the maximum gains in performance to be made for a minimum effort. The absolute shape of the modifications can be approximated but are best studied by incorporating them on the sailplane and making another measured flight evaluation. The use of this method will show up points that may have been missed during previous studies, or may become apparent due to improvements on the poorest areas.

On the Plank the predicted modifications required are outlined below:

A. On the canopy, a smooth fitting juncture at the forward section is required.

B. Extending the rear section to the trailing edge will reduce the pressure gradients.

C. A fillet starting as far forward as possible should then be added.

D. Fillets should be added to the lower intersection.

E. The extension of these fillets aft of the trailing edges will serve to reduce the drag still further.

F. The use of a rounded skid will reduce the drag of the lower surface of the pod, and rounding out the bottom will result in an additional improvement.

G. The elimination of the forward section of the tip fins and rounding of the tip will serve to smooth out the flow in this region.

These modifications are shown and designated in Figure 5.

Also at this time the very obvious drag items should be eliminated where possible. On the Plank these are; eliminate external wing and nose tow hooks, eliminate tip wheels, install internal drag rudder actuators, add gap covers on lower surfaces of elevons, and seal elevon ends with fur strips.

When these are made and another series of performance flight tests are made, there should be a marked improvement in performance through the entire speed range.

The system of modification outlined here is based on making each change that is made tend toward more performance, rather than a random system which may or may not yield better performance. It was through these systematic modifications that sailplanes such as the RJ-5 (Ref. 4) and the "Tiny Mite" (Ref. 5) were developed.

References

1. Backstrom, A. A., "The EPB-1 Flying Plank," Soaring, July-August, 1954.

2. Raspet, A., "Potential of The Sailplane," OSTIV Publication II.

3. Hoerner, S., Aerodynamic Drag, p. 112.

4. Raspet, A., "Systematic Improvement of the Drag Polar of the Sailplane RJ-5," Soaring, September-October, 1951.

5. Raspet, A., and Parker, R., "The Low Drag Sailplane," Soaring, November-December, 1954.

VHS of Robert Hoey's presentation on November 20, 1999, covering his group's experimentation with radio controlled bird models being used to explore the control and performance parameters of birds. Tape comes with a complete set of the overhead slides used in the presentation.

Cost :
$10.00
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FLYING WING SALES

BLUEPRINTS – Available for the Mitchell Wing Model U-2 Superwing Experimental motor glider and the B-10 Ultralight motor glider. These two aircraft were designed by Don Mitchell and are considered by many to be the finest flying wing airplanes available. The complete drawings, which include instructions, constructions photos and a flight manual cost $140, postage paid. Add $15 for foreign shipping.

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AVAILABLE PLANS & REFERENCE MATERIAL

VIDEOS AND AUDIO TAPES

(ed. – These videos are also now available on DVD, at the buyer's choice.)

VHS tape of Al Bowers' September 19, 1998 presentation on "The Horten H X Series: Ultra Light Flying Wing Sailplanes." The package includes Al's 20 pages of slides so you won't have to squint at the TV screen trying to read what he is explaining. This was an excellent presentation covering Horten history and an analysis of bell and elliptical lift distributions.

Cost: $10.00 postage paid
Add: $ 2.00 for foreign postage

VHS tape of July 15, 2000 presentation by Stefanie Brochocki on the design history of the BKB-1 (Brochocki,Kasper,Bodek) as related by her father Stefan. The second part of this program was conducted by Henry Jex on the design and flights of the radio controlled Quetzalcoatlus northropi (pterodactyl) used in the Smithsonian IMAX film. This was an Aerovironment project led by Dr. Paul MacCready.

Cost: $8.00 postage paid
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An Overview of Composite Design Properties, by Alex Kozloff, as presented at the TWITT Meeting 3/19/94. Includes pamphlet of charts and graphs on composite characteristics, and audio cassette tape of Alex's presentation explaining the material.

Cost: $5.00 postage paid
Add: $1.50 for foreign postage

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