

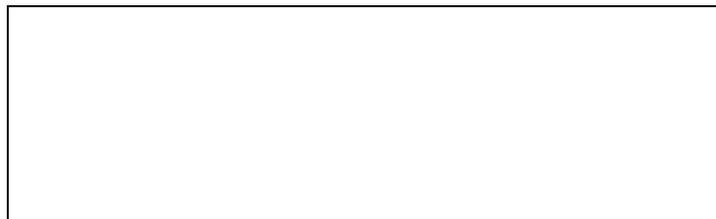
# T.W.I.T.T. NEWSLETTER



DSRV (Dynamic Soaring Research Vehicle) has proven that dynamic soaring is possible on the lee side of a ridge line. This model hit speeds of over 230 mph during the research flights.

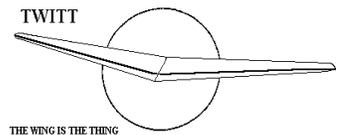
## T.W.I.T.T.

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



The number after your name indicates the ending year and month of your current subscription, i.e., 0309 means this is your last issue unless renewed.

Next TWITT meeting: Saturday, September 20, 2003, beginning at 1:30 pm at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - Southeast 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
- Secretary: Phillip Burgers** (619) 279-7901
- Treasurer: Bob Fronius** (619) 224-1497
- Editor: Andy Kecskes**
- Archivist: Gavin Slater**

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)  
 E-Mail: [twitt@pobox.com](mailto:twitt@pobox.com)  
 Internet: <http://www.twitt.org>  
 Members only section: ID – **twittmbr**  
 Password – **member02**

Subscription Rates: \$20 per year (US)  
 \$30 per year (Foreign)

Information Packages: **\$3.00 (\$4 foreign)**  
 (includes one newsletter)

Single Issues of Newsletter: **\$1.50 each (US) PP**  
 Multiple Back Issues of the newsletter:  
**\$1.00 ea + bulk postage**

Foreign mailings: \$0.75 each plus postage

Wt/Issues	FRG	AUSTRALIA	AFRICA
1oz/1	1.75	1.75	1.00
12oz/12	11.00	12.00	8.00
24oz/24	20.00	22.00	15.00
36oz/36	30.00	32.00	22.00
48oz/48	40.00	42.00	30.00
60oz/60	50.00	53.00	37.00

**PERMISSION IS GRANTED to reproduce this publication or any portion thereof, provided credit is given to the author, publisher & TWITT. If an author disapproves of reproduction, so state in your article.**

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).

**TABLE OF CONTENTS**

**President's Corner ..... 1**  
**This Month's Program ..... 2**  
**Letters to the Editor ..... 2**  
**Available Plans/Reference Material ..... 9**



**PRESIDENT'S CORNER**

**H**opefully, you are going to get this newsletter on time. My home computer decided to go through a hard drive crash on Thursday, just as I was getting ready to input the last pieces to fill it out after Norm Masters article. So here it is Monday evening, my Internet connection is still down due to some internal settings and I have 4 more pages to fill so this can be delivered to the printer on disk first thing in the morning. Oh well, so much for whining.

If you weren't at the SHA Western Workshop over the Labor Day weekend, you missed some really good speakers. Although there wasn't anything directly related to flying wings, there was some good information passed along about general building techniques for both full size and model aircraft. It was also good to see that many of the speakers were some of the new blood in SHA offering up new ideas to help provide members with low cost options for home building. One of the demonstrations was on how to test your glue joints with a simple rig using a small hydraulic jack and gage. This could mean the difference between the FAA accepting or rejecting your choices of glues and woods.

One of the "young guns" was from the NASA cooperative program with colleges who showed us how they had actually accomplished dynamic soaring on the lee side of a ridge using a commercially available foam flying wing. What it also proved was that the technique can't be used by a human flown aircraft due to the high g-loadings encountered at the turning ends of the flight track. Although not really practical at this point it was still fascinating to watch the video of a model doing 230 mph in a tight oval and still accelerating.

As soon as you get your 2004 calendar make sure to mark Labor Day for the next Western Workshop and plan on attending.



## SEPTEMBER 20, 20023 PROGRAM

**W**e regret to inform our members that we were unable to put together a formal program again this month. We will still have a meeting so that all those that wish to attend can come and exchange ideas about all flying wing things they want to talk about. We will have the usual coffee and donuts for those of you who like such things. We will also have some video footage from the History channel's recent airing of Luftwaffe aircraft during WWII, which includes the Horten designs and animations of what some of them would have looked like in flight.

We apologize for the lack of programs in recent months, however, as we have noted in the past we have exhausted just about every known program in the southern California area relative to flying wings. If you know of anyone who could offer some insight into an aspect of design or construction that is applicable to flying wings, please let us know and we will try to make contact.

---

### A Brief Overview Of The History & Technology Of Junkers Flaps

By Norman Masters

**I**n 1921 German patent DRP Nr. 396 621 was granted to Junkers Flugzeugwerke AG for a new device called "doppelflugel". Hugo Junkers didn't share details about the new device but he did spread rumors that his company was developing something that would revolutionize aircraft control. In 1925 the revolutionary system was finally ready to be tested on an airplane, the Junkers T 29 "Buegeleisen" (Hot Iron). Many Junkers planes of the late '20s and '30s had doppelflugel among them the workhorse JU-52 transport/bomber and the JU-87 "Stuka".

I got my first glimpse of a Stuka when I was about 13 and, even then, I thought it was a pretty strange looking airplane. Besides all the other unusual features, I knew, from seeing other airplanes, those big gaps between the wing and *all* the control surfaces weren't normal. Of course no member of this club could ever build something as aerodynamically dirty as the JU 87 I only bring it up as an example of a production airplane with the feature being discussed. The Stuka was slow for the power with a top speed of

255 mph (402 km/h) but the customer must have been satisfied with its performance and reliability because over 5,000 were built.

By the time the patent expired, aviation was moving into higher speeds and the Junkers flaps, or "helper wings", may have seemed too reminiscent of the biplane era. After all, what is doppelflugel other than a biplane with extreme stager, a very small interplane gap, the bottom wing less than 30% the chord of the top wing and adjustable decalage?

From 1935 to 1940, the NACA conducted an investigation into external airfoil flaps basically reproducing the test program that Junkers must have done 14 years earlier. This investigation was carried out with wind tunnel models and a Fairchild 22 parasol monoplane. The main wing for all the wind tunnel models was either the NACA 23012 or the NACA 23021 and the flap airfoils were either 23012 or Clark-Y.

The Fairchild's factory wing was replaced with a wing+external airfoil flap of the same overall area and planform. The test wing consisted of an NACA 23015 main wing with full span external airfoil flaps of Clark-Y section, which could be deflected either symmetrically for high lift or asymmetrically for roll control. The test wing ended up weighing 65 pounds more than the factory wing. Although the report (TN-604) doesn't say where that extra weight is (they *may* have built the wing heavier than the factory wing), it's prudent to assume that at least half of the extra weight is in the flap and therefore represents a mass hanging over the trailing edge which is a potential source of flutter. Although that sounds bad, it's really no worse than an extended Fowler flap.

In fact, the Junkers flaps are very similar to extended Fowler flaps with the additional ability to operate as very good roll control stabilators. If rigged as flaperons they produce large adverse yaw when used for high lift and roll at the same time. Fortunately, when used in the role of elevons, we don't have to deal with that problem and we get the added bonus that, when activated, they produce better lift to drag ratios than plain trailing edge surfaces.

The NACA tests showed that a doppelflugel, with the helper wing set at an AoA of -3.2 degrees, had lower drag than the main wing alone. However, the NACA 23012 + Clark Y doppelflugel has higher minimum drag than the NACA 23010 (Figure 1), which has about the same over-all thickness to chord ratio.

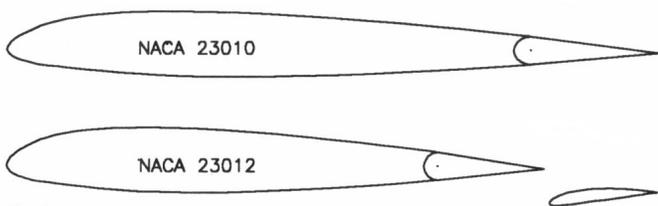


fig 1

Over the years Junkers flaps have shown up on many different light airplanes, (mostly home builds such as the Avid Aircraft), and with good reason. The phrase, “one of the most generally satisfactory high-lift devices investigated to date”, keeps recurring throughout the NACA reports. Figure 2 shows a comparison of a plain aileron deflected 30 degrees up and a wing with a stabilator deflected the same amount.

Both of these control systems provide a pitching moment sufficiently large to control the attitude of a flying wing. The mechanism by which they achieve this control is a bit different, however. In the case of the thin wing with conventional elevons [fig 2 a], the result of an upward displacement of the elevon is that the wing tip becomes a highly cambered airfoil flying upside down.

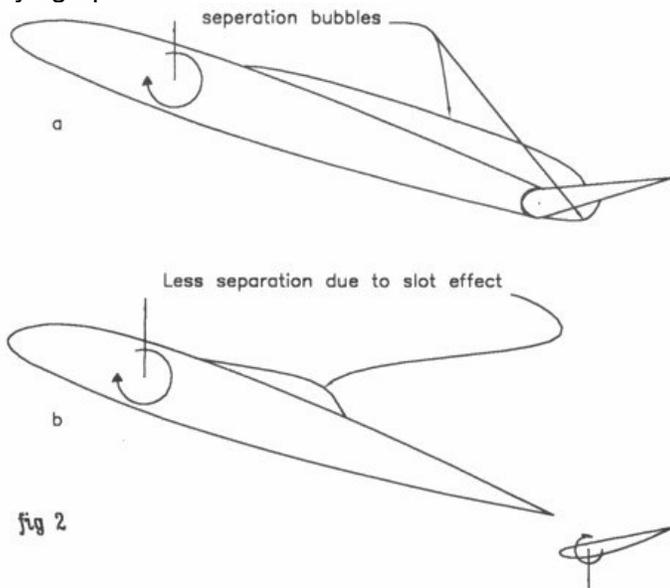


fig 2

Such a wing can be expected to produce very little lift and a strong pitching moment due to its camber but also high drag (L/D may be as low as 4). When the AoA has reached the stall angle of the basic wing, this system provides a measure of protection from tip stall by simply raising the trailing edge high enough to intercept the separated boundary layer and thus close the bubble.

The fat wing with the stabilator [Fig 2 b] produces more lift and less drag because the accelerated air through the slot has an invigorating

affect on the boundary layer of the main wing, not just near the TE but all around the airfoil. In a mathematical sense, one could say that the slot acts as a pump to increase the strength of the bound vortex. This favorable interference allows the main airfoil to reach a slightly higher  $C_{Lmax}$  than usual with the same or even *decreased* drag. The controlling moment is provided by the downward lift of the stabilator. Note that, since it is an independent airfoil, the stabilator has its own pitching moment and since it is usually going to be deflected up, we can make that moment work for us by flipping it upside down as in [fig 2 b].

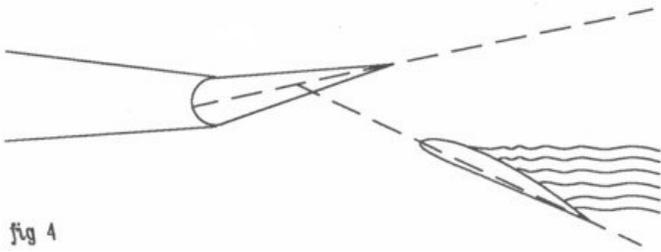
Although the Mitchell wings appear to be the only a/c produced in quantity to use a negatively cambered external airfoil flap, Don Mitchell wasn't the only one to experiment with that idea. The Soviet flying wing “BOK-5” of 1937 used just such a surface attached to the trailing edges of conventional flaps and ailerons [fig 3]. The drawing I have doesn't show a linkage so I don't know if it was a trim tab, some other kind of tab, or if it was rigidly attached and just formed a slotted TE.



fig 3

This is not to suggest that Mr. Mitchell was influenced by the BOK-5. In fact, I'm sure he wasn't. The Soviets were notorious for blocking the free exchange of information and any innovations made by Soviet engineers didn't show up in Western publications for years.

The NACA didn't test the arrangement used on the BOK-5 but they did test a system of conventional aileron with a full-span external airfoil flap behind it but hinged to the wing so that the surfaces could be moved independently. In this experiment the helper wing was a high lift device only and the aileron was used for roll. This arrangement produced very high roll and yaw moments but the moments did not increase linearly with surface deflection. Instead, it has hysteresis due to flap stall which occurs on the down going wing when the plane rolls with the flaps down. This flap stall is due to the flap and aileron forming an expanding channel (diffuser) when they are deflected in opposite directions [fig 4].



The pilot would experience a sudden increase in roll rate when the aileron deflection passed some critical value and that critical value changes with flap setting. Clearly, the arrangement shown in figure 4 is not appropriate as a roll control system for manually piloted aircraft. However, something similar may make a good drag rudder, especially since a portion of the positive effect on wing circulation mentioned earlier still exists even though the flap is stalled.

Figure 5 shows two flap arrangements and the associated envelope polar. Most of the tests were performed with the 20%  $C_w$  flap with only a limited number using the 30%  $C_w$  flap. The result is that some assumptions have to be made. For instance, the envelop polar appears to show that the 20%  $C_w$  flap has more drag in the midrange than the 30%  $C_w$  flap but the writers of TN 603 believe that the drag rise is due to axis *a* moving the leading edge of the flap too high and aft relative to the trailing edge of the wing, thus losing some of the slot effect. Naturally, this problem wouldn't manifest in a tip stabilator.

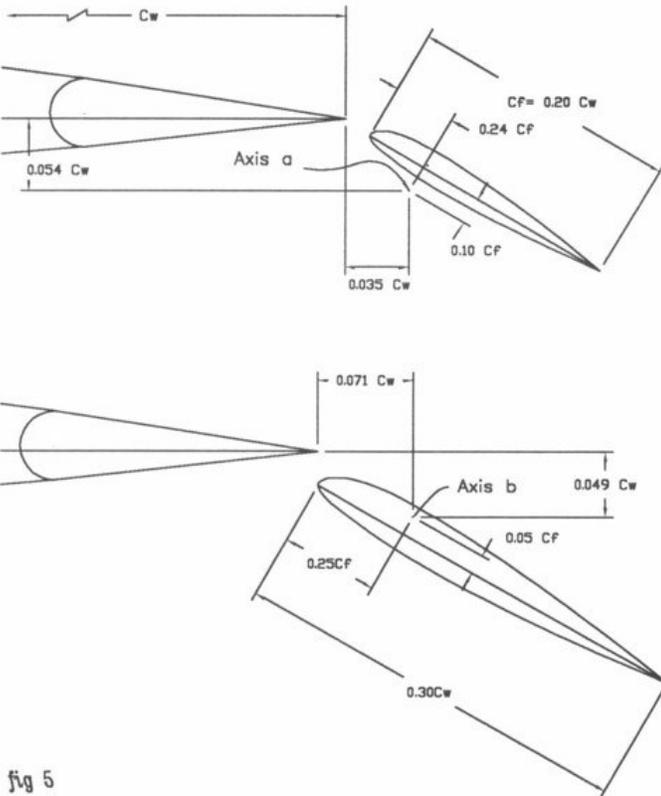
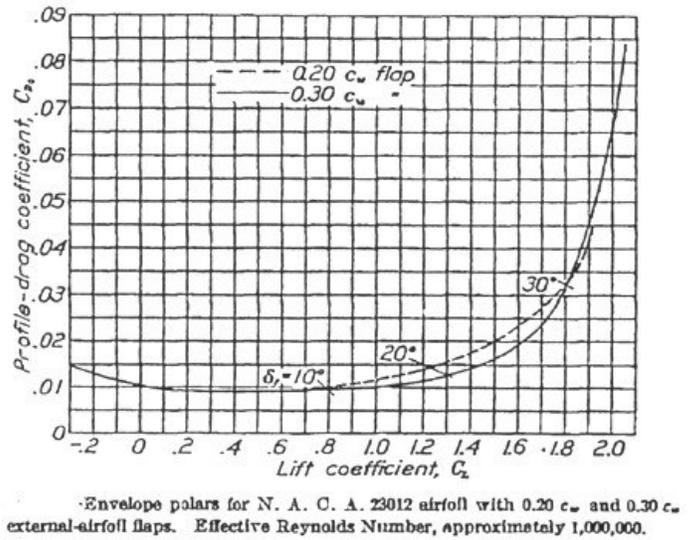


fig 5



Speaking of tip stabilators, Figure 6 shows a rubber powered free-flight model by D. R. Wyett of the UK, called the "Manxie. III". It was published in the 1959-1961 issue of Frank Zaic's "Model Aeronautics Year Book" the comment on the drawing says it was a flying for fun model, not a duration model.

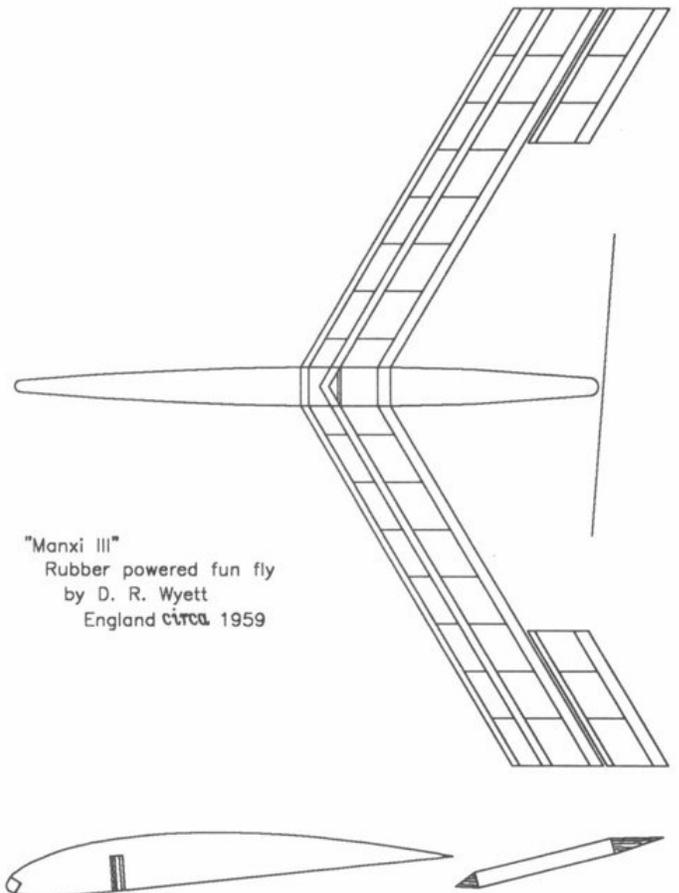


fig 6

Although not as common, placing the auxiliary airfoil above the main wing has also been tried as shown in Figure 7. Figure 7a shows the arrangement that Alexander Lippisch used on his "Delta IV" (AKA Fieseler "Wesp"). The only information I have on this is from one paragraph in a 1945 article in "Aircraft Engineering" by A. R. Weyl. He says that adding the auxiliary airfoil produced a stable wing system without an increase in drag over that of the main wing alone but the  $C_{lmax}$  was reduced by 8 to 15 percent (but that's the problem with reflexed airfoils, isn't it?).

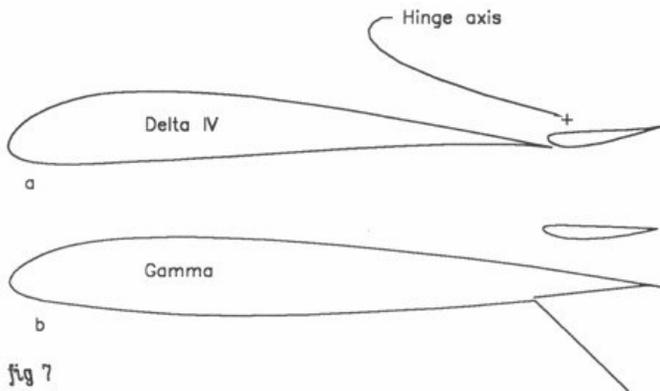
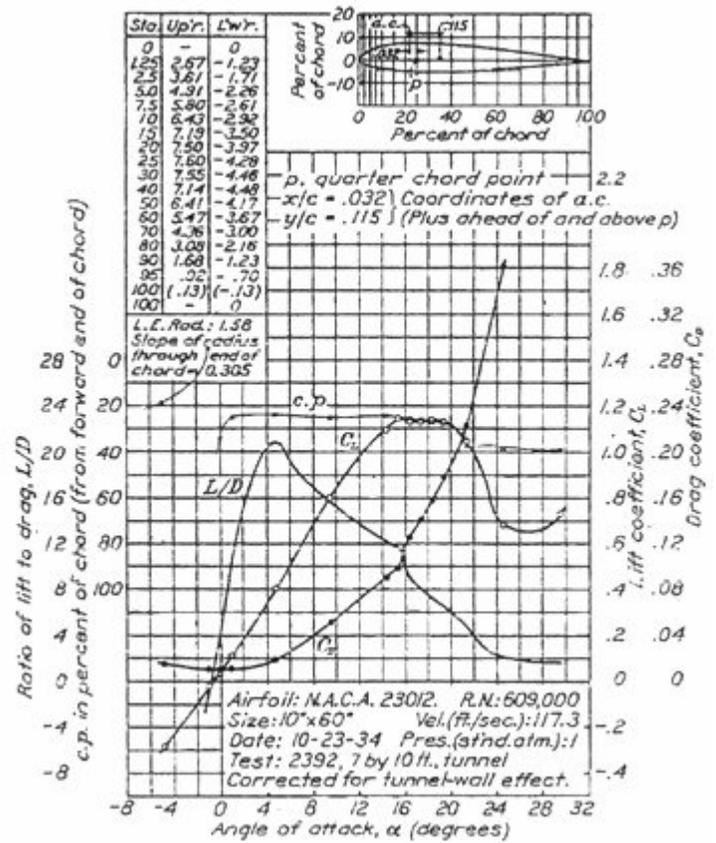
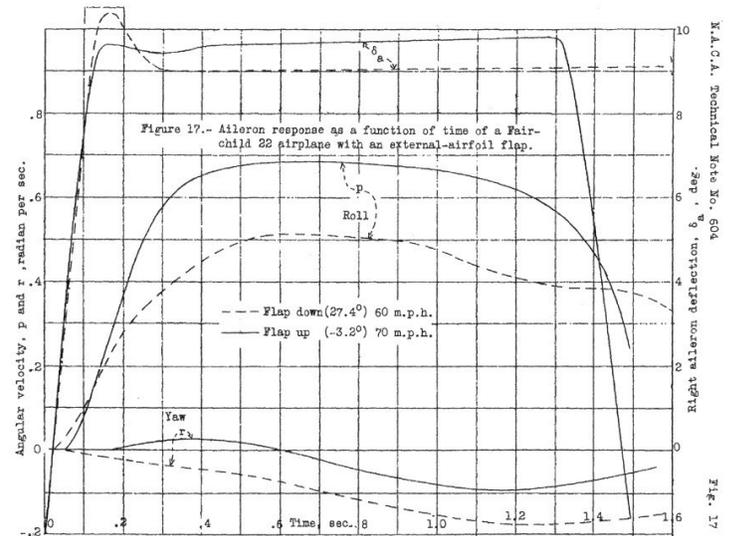
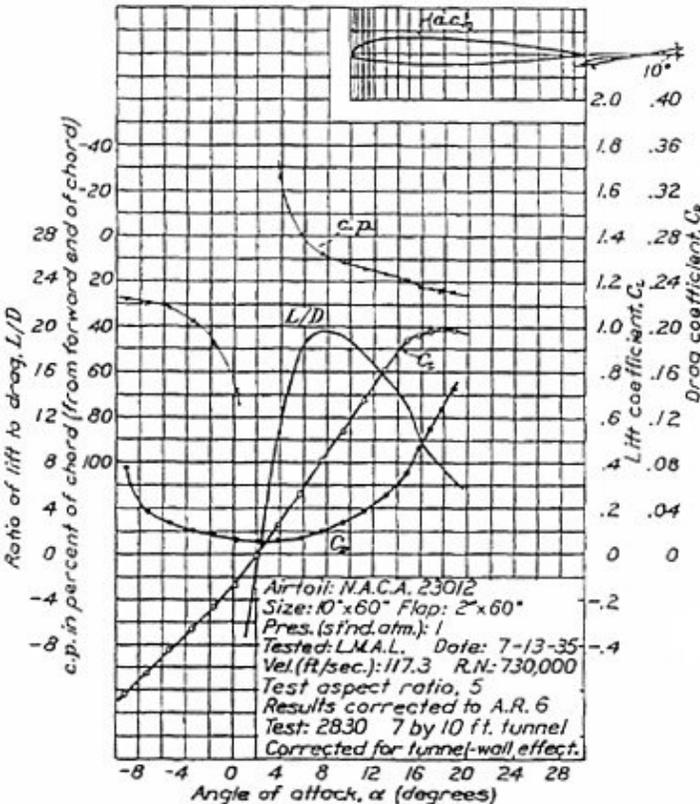
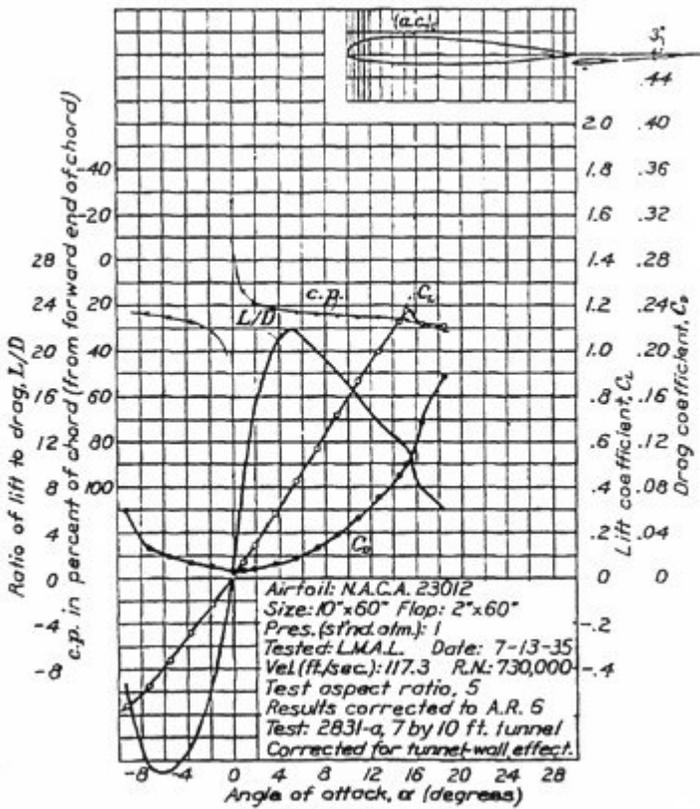


Figure 7b shows an arrangement Northrop tried on the pre-production "Gamma". The wing was equipped with full span split flaps and park bench ailerons



Pro	Con
Near zero lag	Adds weight to the trailing edge
Higher roll rate than plain ailerons	Higher pitching moments than plain flaps
Shortened ground run when used as flaps	Appears to be vulnerable to FOD and ice
Favorable effect on main airfoil circulation <i>Higher <math>C_{lmax}</math></i>	More critical of design details than plain flaps
In the position of minimum drag the auxiliary wing can actually decrease the drag of the basic wing	Slightly higher drag than solid wing of same over-all thickness
No need to seal hinges	
Remain effective when the main wing is stalled	



See next page for a diagram showing external control surfaces on a Fairchild aircraft.



**LETTERS TO THE EDITOR**

August 5, 2003

The Wing IS The Thing..

I was doing some research, and came across your website updated till 12/2002 tonight..

I have been thinking along the lines which your association thinks with regard to flying machines, and was enchanted by the information on the web site....

Is there another site with more up to date information, I appreciate the work you fellers have put into the theme.....

Having devoured most of what the site has to offer, I want more.....

Thanks for the effort. It is appreciated...

My problem with this topic, (and lots of interests) is that I have too many....

I just have to get involved, and DO rather than think about doing things, and it is great to see people who have got stuck into their hobby/lifestyle...

Awaiting a response....

Mark Goddard (Aus)  
 "MDG" kadmow@iprimus.com.au

N.A.C.A. Technical Note No.604

Figs.1,2

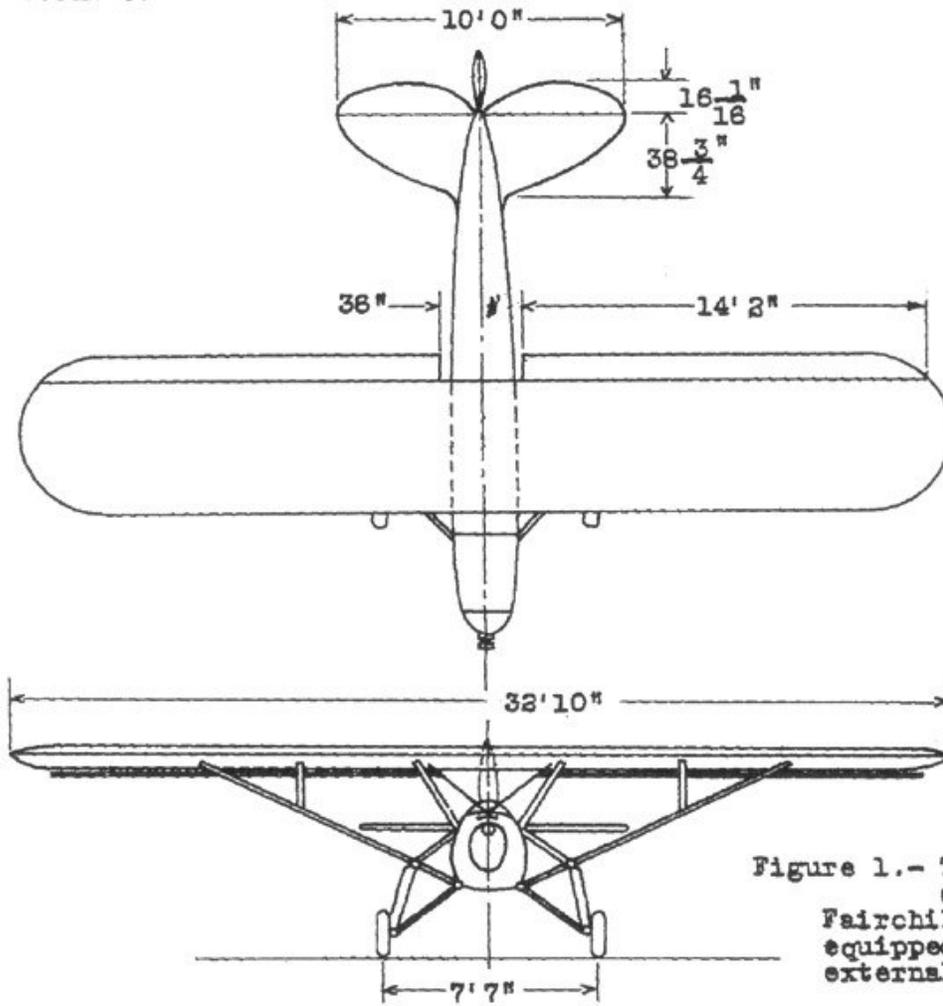


Figure 1.- Three-view drawing of Fairchild airplane equipped with an external-airfoil flap.

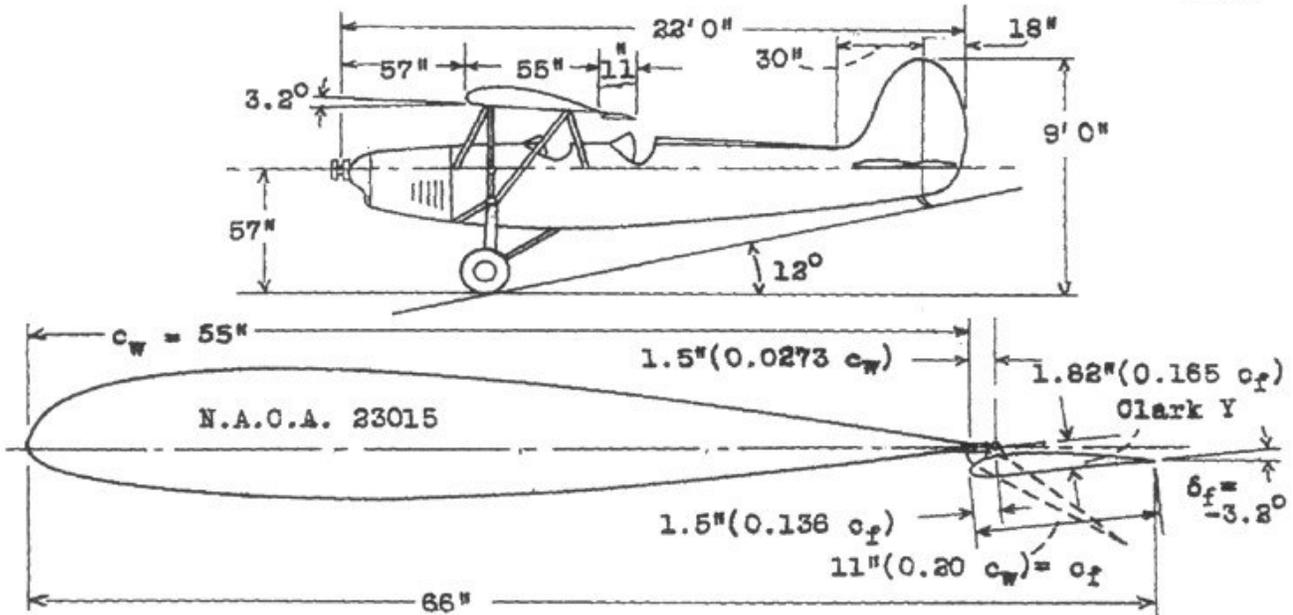


Figure 2.- Sectional view of wing showing location of external-airfoil flap

August 16, 2003

*(ed. – I wrote Mark to let him know of the new location for the TITT website so he could get more information for the updated pages that I have managed to work on since the end of last year. To date I have not heard back from him so don't know if he is still interested or, like me, just hasn't had the time to continue his research.)*

August 7, 2003

TWITT:

**I** just happened on to your website by accident. What I found there threw me back 35 years to a barn in Washington State.

In that barn was a magical thing of beauty and engineering.

On your website links area is a header for a 'Northrop/Bowlus Flying Wing'. The photograph is not very clear, but it is clear enough that I recognized the wing I had admired as a kid. That wing still exists. It is hanging in the barn of one Mr. Jack Laister.

Jack was if I am not mistaken, one of the people on the design team for the flying wing. He also designed and flew most of the troop transport gliders that were deployed during the war. I have no idea where Mr. Laister is now but I am sure that some one from the DOD could help you find him.

George Longshore  
longshore@cmn.net



*(ed. – I sent George a larger copy of the photograph from the website, but it turned out not to be the aircraft he was thinking about, as can be seen from this follow-on message.)*

Not the same plane

**I** have been investigating and have found that the plane of my childhood is not the plane I thought it was.

The plane I thought was a Northrop was in actuality a "Favelle" [don't know about the spelling] flying wing. The plane was a project bought by Mr. Mike Anchuster and never flew. It was destroyed when Mr. Anchuster's motor home backed into it in the barn.

My sister has no information about where Mr. Anchuster is now. His last known whereabouts were Orcas Island Washington State.

I searched the phone book there but he is not listed. I would guess that he would be in his 80's now.

Jack Laister was the name on the flying helmet that lived inside the plane. Perhaps Mr Laister knows how to find Mr. Anchuster. I would like to know more about this plane and how it came here. Obviously there should be some information about the Favelle but I have not been able to find out a thing other than that is what it was called. The structure was wooden ribs with what looked like silk span and dope covering. I never saw the canopy on the plane so I am not sure of the shape of it, but there was a ridge where a canopy would have sealed. The bottom of the fuselage had a hole in it that I thought would be for 'Flintstone brakes' where you could put your feet down. Instruments were gone or never installed in their holes. I remember 4 or 5 holes.

Do you have any information about the Favelle? Now that my memory is proving not too reliable, I am very interested in this plane. Do you know of anyone that might have information about the Favelle? I think it would be a good recreation project if there plans anywhere.

George Longshore

*(ed. – Of course now I am not sure what airplane he is talking about other than it was a Favelle. Perhaps one of our northwest members know more about this aircraft from the past and where it might be now, like one of the aviation museums in the Washington area. If so, please let me know so I can pass this information along to George.)*

August 15, 2003

MSU Horten IV report

Hi Andy--

I am finally getting around to telling everybody that has a link to my old ISP that I've moved and where the new link to the Horten IV report is.

Boilerplate follows:

I was looking at your links page at: <http://members.cox.net/rebid/justlinks.html> and noticed that the link to the MSU performance analysis of the Horten IV is out of date. If you want to continue to link to the report the new link is: [<http://users.acsol.net/~nmasters/H-IV-report.html>](http://users.acsol.net/~nmasters/H-IV-report.html)

BTW the author of that report, Dezo Gyorgy-Falvy, died in 2001. His kids put up a memorial page in his honor at: <http://www.dezso.org/>

Norman Masters  
nmasters@acsol.net

*(ed. – Thanks for the update on the links. I have had several people write we lately with other links that are no longer valid, but I just haven't had time to go into the website and get them corrected or removed, as applicable.)*

*If anyone comes across a link on our site that is no longer connected to the destination or it has changed to a new URL, please make sure to drop me a line and let me know. I will get to them, eventually, and I do want our website to be as accurate as possible.)*

August 21, 2003

Delta wing in Michigan

Hi,

I am trying to find an article on the TWITT website, that I saw a few years back. It was a homebuilt single seat delta wing with a Lycoming engine in a pusher configuration. It was built by a guy in Michigan that also killed himself at take off on first flight.....does it ring a bell?

I would appreciate any info!

Regard's

Hakan Langebro  
hlangebro@safireaircraft.com



*(ed. – I sent Hakan a copy of the picture I thought he was looking for and sure enough it was the one. However, I haven't had the time (there is that time thing again) to finish doing the research through the electronic records to see if I can find the rest of the information that went with it.*

*If anyone out there happen to make a copy of the pages from the website when it was up, could you please send me a copy so I can pass it along to Hakan.)*

Hi Andy,

Yes that is exactly the aircraft I am talking about. The web article was several pages, including pictures from wind tunnel testing, building the prototype etc. I know the name of the aircraft; Delt-Air 250 (not Delta-Air 250), and it was built by Herb (Herbert) Dean from Flint, Michigan. I hope this might help you finding some more info.....

It would be very nice if you can find it again!

Thanks

Hakan Langebro

August 22, 2003

Request for images

I am an hobbyist aviation writer from Estonia writing for local biggest tech magazine TM ([www.tehnikamaailm.ee](http://www.tehnikamaailm.ee)). I'm preparing currently my sixth article. This time about tailless aircraft starting from the beginning. Therefore I approach you in

looking for help. Currently all the image materials I have are black and white which is not enough. Maybe you can help me regarding the color images of the tailless aircrafts. Particularly interesting are Horten's planes and modern BWB aircrafts. Also very early other makes are in interest. Images have to be high in quality - those that are currently on your page are not in print quality.

In return I can provide information about Estonian Horten III replica which in the status of getting ready for first flights in next year.

Regards,

Kaido Tiigisoon  
Kaido.Tiigisoon@emt.ee

*(ed. – If there is anyone out there with some high quality color photos of flying wings like the Horten designs and BWB aircraft, please contact Kaido and let him know if you would be willing to share them for his article. I will write him and see if Al Bowers at NASA Dryden can also help with the BWB pictures or at least point him in the right direction with other contacts.)*

August 23, 2003

Flying Wing Symposium 2003  
(14. Nurflugelsymposium 2003)

It is time for the new German flying wing symposium and maybe that is of interest for you flying wing enthusiasts.

This year the meeting will take place October 4 and 5. Location is Scheidegg in Germany, as usual. For our 14th symposium we have organized nine presentations. The meeting will be held in German language. Everybody interested is welcomed to contact me for further information (akr\_stadler@web.de, please give me some time to answer, because I do this in parallel to my job and family;-)).

As the titles of the presentations are in German, I give a short translation here:

- Plank model flying wings by C. WELLER
- Ground-effect technology by M. BOESE
- A short introduction to Finite Difference Methods by R. MEYER
- A presentation about his Mitchell U2 by W. UHL
- A presentation of the Stingray textil-pneumatic testbed by A. REINHARD
- Plank model with artificial yaw-stability by H. SCHENK
- Electric propulsion system for a hang-glider by N. SCHNELL

- A presentation of the Horten IV-project by B. EWALD
- A short overview about the Northrop flying wings by R. STADLER

I hope, the symposium will help keeping the flying wing idea alive.

Greetings  
Reinhold Stadler  
mw40200@mucweb.de

**AVAILABLE PLANS & REFERENCE MATERIAL**

**Coming Soon: Tailless Aircraft Bibliography Edition 1-g**

**Edition 1-f**, which is sold out, contained over 5600 annotated tailless aircraft and related listings: reports, papers, books, articles, patents, etc. of 1867 - present, listed chronologically and supported by introductory material, 3 Appendices, and other helpful information. Historical overview. Information on sources, location and acquisition of material. Alphabetical listing of 370 creators of tailless and related aircraft, including dates and configurations. More. Only a limited number printed. Not cross referenced: 342 pages. It was spiral bound in plain black vinyl. By far the largest ever of its kind - a unique source of hardcore information.

But don't despair, Edition 1-g is in the works and will be bigger and better than ever. It will also include a very extensive listing of the relevant U.S. patents, which may be the most comprehensive one ever put together. A publication date has not been set yet, so check back here once in a while.

Prices: To Be Announced

Serge Krauss, Jr. skrauss@earthlink.net  
3114 Edgehill Road  
Cleveland Hts., OH 44118 (216) 321-5743

**Personal Aircraft Drag Reduction**, by Bruce Carmichael.

**Soft cover**, 81/2 by 11, 220 page, 195 illustrations, 230 references. Laminar flow history, detailed data and, drag minimization methods. Unique data on laminar bodies, wings, tails. Practical problems and solutions and, drag calculations for 100HP 300mph aircraft. 3d printing. \$25 post paid.

Bruce Carmichael brucecar1@juno.com  
34795 Camino Capistrano  
Capistrano Beach, CA 92624 (949) 496-5191



**VIDEOS AND AUDIO TAPES**



**VHS** tape containing First Flights "Flying Wings," Discovery Channel's The Wing Will Fly, and ME-163, SWIFT flight footage, Paragliding, and other miscellaneous items (approximately 3½+ hours of material).

Cost: \$8.00 postage paid  
Add: \$2.00 for foreign postage

**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  
 Add: \$2.00 for foreign postage

**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

**VHS** of Paul MacCready's presentation on March 21, 1998, covering his experiences with flying wings and how flying wings occur in nature. Tape includes Aerovironment's "Doing More With Much Less", and the presentations by Rudy Opitz, Dez George-Falvy and Jim Marske at the 1997 Flying Wing Symposiums at Harris Hill, plus some other miscellaneous "stuff".

Cost: \$8.00 postage paid in US  
 Add: \$2.00 for foreign postage

**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 postage paid in US  
 \$15.00 foreign orders

**NURFLUGEL**

"Flying Wing"

by Dr. Reimar Horten & Peter Selinger

350 illustrations  
 German & English text  
 Limited number of the "flying wing bible" available  
 Cost: \$49.00 plus \$4 shipping and handling

SCOTT flycow@aol.com  
 12582 Luthern Church Road  
 Lovettsville, VA 20189 Sole U.S. Distributor

**Tailless Aircraft in Theory and Practice**

By Karl Nickel and Michael Wohlfahrt

498 pages, hardback, photos, charts, graphs, illus., references.

Nickel and Wohlfahrt are mathematicians at the University of Freiburg in Germany who have steeped themselves in aerodynamic theory and practice, creating this definitive work explaining the mysteries of tailless aircraft flight. For many years, Nickel was a close associate of the Horten brothers, renowned for their revolutionary tailless designs. The text has been translated from the German *Schwanzlose Flugzeuge* (1990, Birkhauser Verlag, Basel) by test pilot Captain Eric M. Brown, RN. Alive with enthusiasm and academic precision, this book will appeal to both amateurs and professional aerodynamicists.

Contents: Introduction; Aerodynamic Basic Principles; Stability; Control; Flight Characteristics; Design of Sweptback Flying Wings - Optimization, Fundamentals, and Special Problems; Hanggliders; Flying Models; Fables, Misjudgments and Prejudices, Fairy Tales and Myths, and; Discussion of Representative Tailless Aircraft.

Order #94-2(9991) (ISBN 1-56347-094-2) from:

AIAA 1-800-682-AIAA  
 1801 Alexander Bell Drive, Suite 500  
 Reston, VA 20191-4344 USA  
 Members: \$59.95 Non-Members: \$79.95

\*Outside the US, Canada & South America, order from: Edward Arnold (Publishers), a division of Hodder Headline PLC, 338 Euston Road, London NW1 3 BH (ISBN 0 340 61402 1).

**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.

U.S. Pacific (650) 583-3665  
 892 Jenevein Avenue mitchellwing@earthlink.net  
 San Bruno, CA 94066 http://home.earthlink.net/~mitchellwing/

**COMPANION AVIATION PUBLICATIONS**



**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 coop-eration as a means of achieving their goal. Membership Dues: (payable in U.S. currency)

United States	\$21 /yr	Canada	\$26 /yr
So/Cntrl Amer.	\$36 /yr	Europe	\$41 /yr
Pacific Rim	\$46 /yr	U.S. Students	\$15 /yr
(includes 6 issues of <u>SAILPLANE BUILDER</u> )			

Make checks payable to: Sailplane Homebuilders Association, & mail to Secretary-Treasurer, 21100 Angel Street, Tehachapi, CA 93561.

**R/C** Radio controlled **SOARING DIGEST**  
 THE JOURNAL FOR R/C SOARING ENTHUSIASTS

Monthly Journal for RC soaring enthusiasts focusing on technical, construction techniques, and glider design since 1984.

Sample copy: \$2.50. One year subscription: \$30, U.S.A., check or money order only. (Calif. residents please add \$2.25 tax.)

**R/C Soaring Digest**  
 556 Funston Dr., Santa Rosa, CA 95407  
 RCSDigest@aol.com  
 (707) 578-7871  
<http://www.b2streamlines.com/RCSD.html>