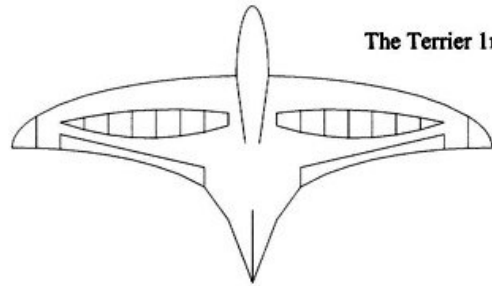
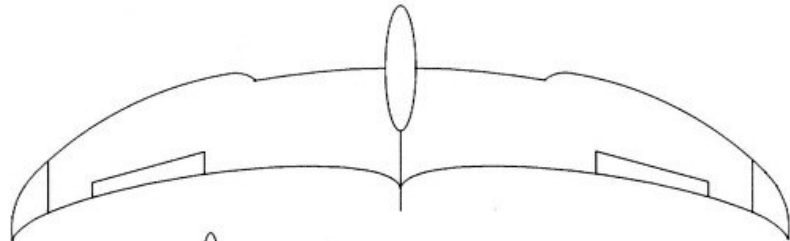


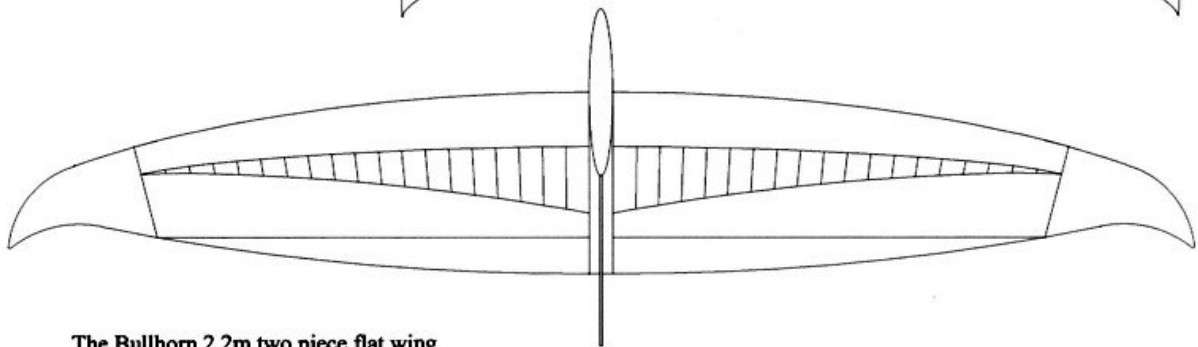
T.W.I.T.T. NEWSLETTER



The Terrier 1m one piece flat wing



The Coathanger 1.6m one piece gull wing



The Bullhorn 2.2m two piece flat wing

See Letters to the Editor for Pete White's article on how he came about building these ellipsoid wings.

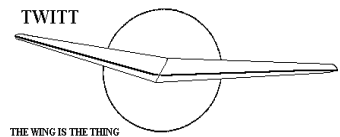
T.W.I.T.T.

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., 0207 means this is your last issue unless renewed.

Next TWITT meeting: Saturday, January 17, 2004, 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.

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- Editor: Andy Kecskes**
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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
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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).

TABLE OF CONTENTS

President's Corner 1
January's Program 2
November Meeting Recap 2
Letters to the Editor 5
Available Plans/Reference Material..... 11



PRESIDENT'S CORNER

First off, I want to thank Rudolf Storck for contributing a copy of his recent book to the TWITT library. It is a great looking book, but unfortunately the descriptions are in German. This is something that can be overcome with time, but in the mean time the pictures are outstanding and include some aircraft we have never come across before. I have included information later in the newsletter on how you can order this book from Amazon through their German affiliate.

We don't usually have many business items to discuss at the meeting or in the newsletter, but we now have to start looking for some new officers for the organization. Bob Fronius is resigning as the Treasurer, we haven't had a Vice President for quite a while, and the Secretary apparently has moved out of the area without letting us know. SO, I am looking for several volunteers who would be willing to have their name placed in nomination for election to one of these offices. The only one with on-going work is the Treasurer's position since the bank account needs to be monitored and balanced on a routine basis. If anyone is interested, please let me know as soon as possible so we can arrange for elections at the next general meeting.

Yes, the newsletter is about a week late this month, but it was unavoidable. About a week before I was scheduled to work on it I had to undergo detached retina eye surgery. Needless to say that sort of put me out of commission for several weeks in terms of using a computer or even reading any material without severe eyestrain on my one good eye. Fortunately, the original surgery and some follow-up laser treatments have taken care of the problem for now. There are no guarantees that it won't happen again, since it is more age related than a physical injury, but I am finally able to press forward.

Andy



**JANUARY 17, 2004
PROGRAM**

We still have not been able to find a qualified speaker for the January program. We will continue to seek someone between now and the next newsletter, and I will update the website with the program if we can come up with one before the next newsletter.

We regret that there haven't been many programs in the past few months. But as I have said in the past, we have sort of exhausted the pool of possible speakers in the Southern California area, even after having several repeat appearances. So if you can help by identifying someone who could do an informal presentation on a model or other project, we would be grateful to have a contact name and number.

**NOVEMBER 15, 2003
MEETING RECAP**

We may not have had a large turnout, but those who were there had a good time cutting, taping and flying their paper models. Things got so hectic I forgot to take many pictures of the building activity, but you can see from the shot below the tables got a little messy with all the leftover paper.

Pat Oliver started with a short overhead presentation explaining why use paper models to try and create new designs. It is cheap, easy to work with and can be modified quickly to change shapes. The drawbacks are the lack of true airfoils and some lack of rigidity in the structure to make them very complicated.

Before turning everyone loose on the paper models, Pat emphasized first read the instructions printed on the particular sheet, then start cutting. Surprising enough, most of us actually followed that instruction, which resulted in less frustration with the results.

So we all began by selecting one of the many plans that Pat provided and got started with the scissors. The cutting went quickly and then the hard part became doing the required folding along the designated lines to form the leading edge shapes. Some did it freehand while others used a rigid straight-edge to make sure the folds were done properly.

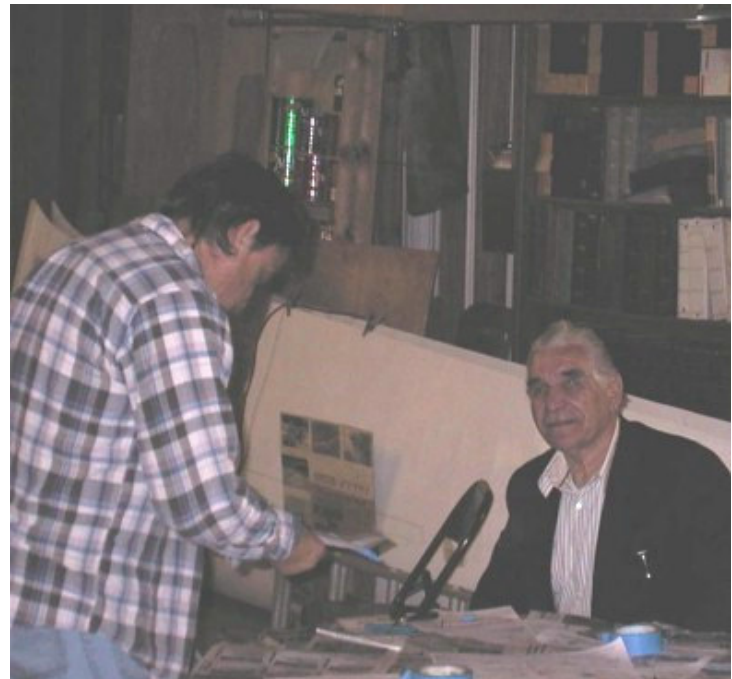
Although you can't see them in the top views included here, each of the planes has a small "fuselage" section protruding below the surface to give you a place to grab for launching. This small piece can

be seen in the top view of the model on page 2 of the last newsletter, and most of them are the configured in the same manner.



ABOVE: Typical work table showing the tools needed for preparing one of Pat's models for flight.

Pat moved around the various tables helping everyone with various parts of the construction and initial setup of the particular model. Each one has its own flight characteristics based on the planform, desired airfoil shape and CG point. The CG was



ABOVE: Pat helping Jorge Paulada with a trim setting on his paper model.

adjusted using multiple layers of masking or electrical tape. Depending on how the tape is applied, it can

also help to create some stiffness in the center section/ fuselage area.

With the shapes formed and the CG in the approximate location, the models started flying around the hanger, some better than others. Pat assisted those in need of more adjustments in trim and CG to try and tweak performance. After a short period of time, just about every glider was performing better, with some doing exceptionally well. *(ed. – I got so busy building and flying my own model I forgot to take pictures of the test flying. Sorry about that.)*

As everyone was test flying their creations, Dominique Veillard broke out his violin and started playing the Happy Birthday tune. Now the question became “whose birthday is it?” Well, it turned out to be Gavin’s, or at least what we decided to make Gavin’s birthday. For as long as we have known Gavin, he has never revealed his birthday, so we took the opportunity of the last meeting for 2003 to throw a little party for him and establish one of our own for him. Elizabeth Veillard baked a great cake and an apple dish, and there was plenty of ice cream to put on these delicious treats.



ABOVE: Jorge and Ralph Wilcox consulting about an adjustment to Jorge’s model.

After a little partying, several people tried tweaking their models a little more, while others watched some of the video Andy shot of George Applebay blowing a new canopy as a demonstration at the recent SHA Central Workshop.



ABOVE: (Right to left) Gavin, Stefan Veillard and Barbara looking over the cake and ice cream we all enjoyed.

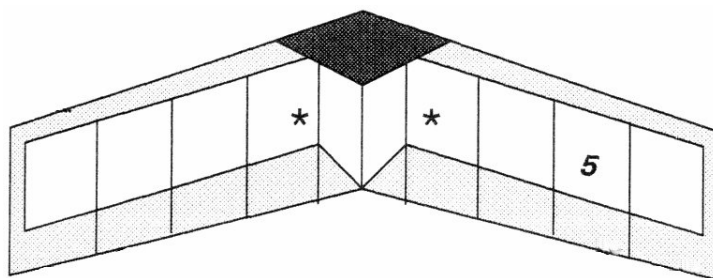
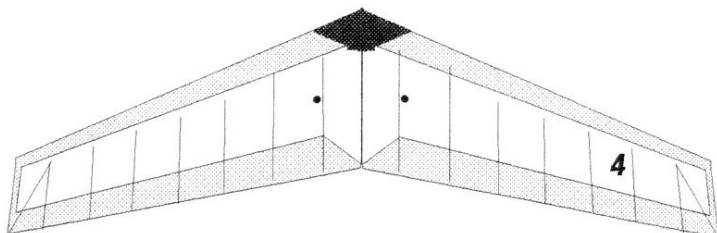
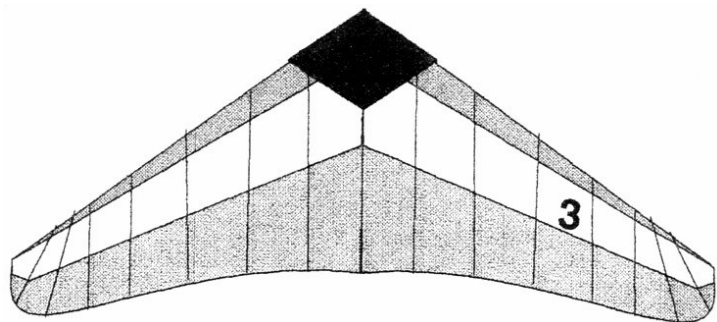
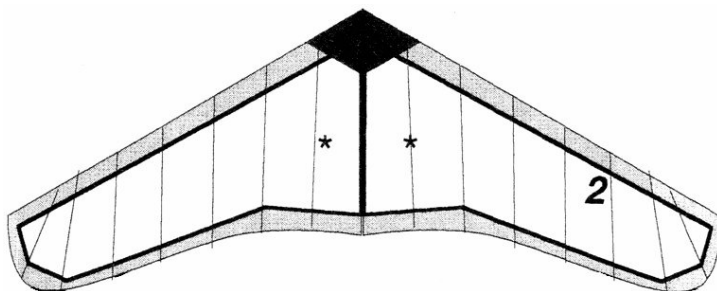
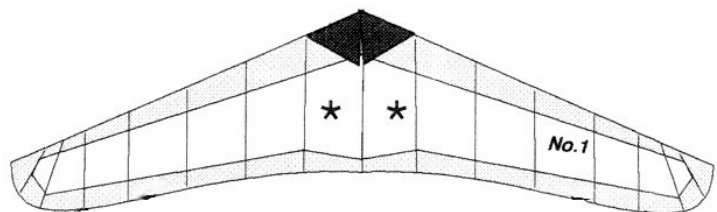
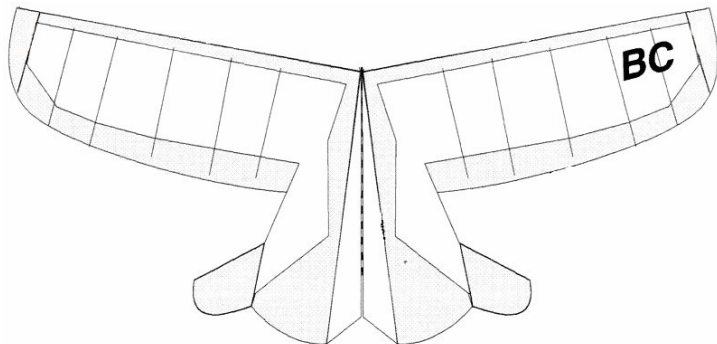
 This was the last meeting for 2003. It hasn’t been the greatest year for programs, but we will be working hard during the next couple of months to find something special for the January 2004 meeting.



ABOVE: Elizabeth taking pictures, Dominique playing the birthday music, and Pat getting ready for another launch attempt.

(ed. – On the following page are the various models that were available to the group for building. BC seemed to be the most popular one I saw flying around the hanger. If you see one you would really like to try, drop me a note and I will make you a copy and put it in

the mail. They are on 8 1/2 x 14 paper so for most would not print out well from the standard home printer, therefore I need to mail you a copy so it is the right size. Pat does have some on 8 1/2 x 11, but these are a nicer size to work with when doing the cutting and folding.)



LETTERS TO THE EDITOR

October 27, 2003

Dear Matt Grimm:

A solar powered aircraft is quite a challenge. Will it be manned or unmanned? I do not have any hands on or detailed design experience on same, but will mention that Dr. Paul MacCready of Aerovironment built a light spaced rib design several years ago that flew the English Channel. It was like an ultralight sailplane with solar cells on the upper wing surface and on the upper surface of a large horizontal tail. He chose an airfoil with all the curvature in the front, and the rear 80% or so chord was flat so the early rigid solar cells would stay on.

Later, Eric Raymond made a solar powered sailplane that was light but looked like a high performance sailplane. The new cells could be formed into a perfect low drag airfoil. Eric studied under a German man powered expert to learn the secrets of light construction using composites.

This is the limit of my knowledge. Good luck.

Bruce Carmichael

(ed. – This was Bruce’s response to the e-mail we received from Matt Grimm in last month’s issue. I have not received any messages from Paul MacCready or Al Bowers which would indicate they provided any guidance, but Bruce’s letter should have given him some directions to look for more information.)

November 25, 2003

TWITT:

Here is the information on my ellipsoid wings as mentioned in the website guest book entry and

the November 2003 newsletter.

The CAD drawings are available to anyone who wants them. I can produce CNC cut ribs but I'd have to work out a price for them.

Regards,

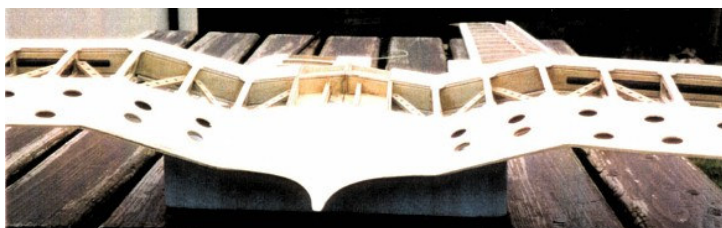
Pete White
 Ludderyhill Farm
 Churchstanton
 Taunton
 Somerset TA3 7PX
 England
 0044(1)823 601 487
 sharon.ludderyhill@lineone.net

(ed. – Thanks to Pete for sending in the following article on his ellipsoid wings, including some good pictures so you can get the true idea of these shapes.)

My introduction to flying wings was inspired by the work of Jupp Wimmer. Some of his models were featured in a British magazine called Quiet Flight International, more of his work can be found on the Net. His wings are of a curvilinear nature and I found them very appealing.

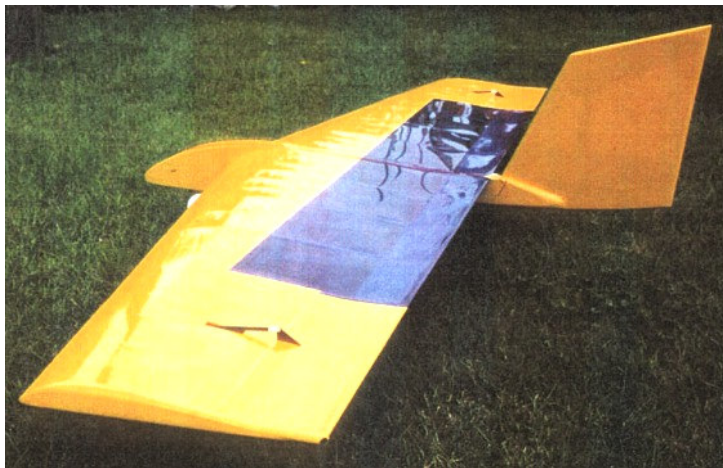
I read various B² books which is where I first became aware of TWITT. The knowledge gleaned from these books and the influence of Herr Wimmer set me off on my own designs.

However, my first wing was a 2m straight taper rear swept model. It featured a gull wing center section with plug on wings. The wings being built around a pair of carbon fiber tubes used as the main spars. The ribs, CJ2509 section, were drilled to accept the tubes and then slid along the tubes and cyanoed in place. Tip fins were basically the last few ribs of the wing turned up through 90 degrees. Prior to launching from the hill I go through a program I developed called C.I.A.S. which could stand for Controlled Initial Assessment Sequence but in reality stands for Chuck It And See! Anyway no problems there but unfortunately although it flew nicely flat and level it suffered from chronic adverse yaw. In hindsight and from further reading I believe this may have been due to the wing tips. So all in all it looked good but flew horribly!



Next venture was a delta inspired by a model called the **Raven** from a B² book. Again. CJ2509

section ribs on carbon tubes but built a complete 2-meter wing with a root of 600mm. This model deviated from the norm by utilizing outboard elevons as opposed to strip elevons along the whole of the trailing edge. I calculated the area of the elevons as 20% of the wing area and constructed short but deep control surfaces towards the tip. I found that very little deflection was necessary to get good maneuverability.



Raven Specs

Wing type: One piece flat delta
 Wingspan: 2 meter
 Section: CJ2509
 Root chord: 540mm
 Tip chord: 340mm
 Spars: Carbon fiber tubes
 Sheeting: Partial

Controls: Outboard elevons

The Terrier, as it came to be known, because it is a nippy wee bugger, comprised a semi ellipse split along its major axis for the leading edge and two semi ellipses set obliquely from the tips to an extended root. I chose EMX07 section as this required no wing twist, had a pitch coefficient of almost zero and is suitable for planks and swept wings. I also opted for a central fin as more reading revealed that wing tip design was actually quite complex.

Some novel building techniques were developed during the build of this model. I required full span strip elevons, which were to be top hinged. This presented a problem due to the compound curves of the upper surface. To overcome this I used the proposed hinge line as the datum for each semi span and aligned the ribs vertically so that the hinge point of each rib coincided with the hinge line. This meant that the ribs each had to be set at a certain height above the building board to obtain a straight hinge line. To this end I left stubs attached to the ribs, the height of which correctly positioned the ribs along the hinge line.

Also it was not possible to use either conventional or tubular spars so instead I built a 5mm by 5mm 'U' channel from tip to tip, top and bottom, and laid up 120K carbon tows in the channel thus creating the spars in situ. The channel followed the maximum depth position of each rib creating a sweeping spar line.

Although only 1 meter in span and only weighing 600g this model will penetrate 35mph winds with ease.



Terrier Specs

Wing type: One piece curvilinear batwing
 Wingspan: 1 meter
 Section: CJ2509
 Root chord: 430mm
 Tip chord: 66mm
 Spars: Laid up carbon fiber tows

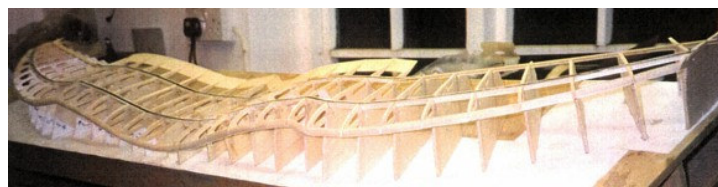
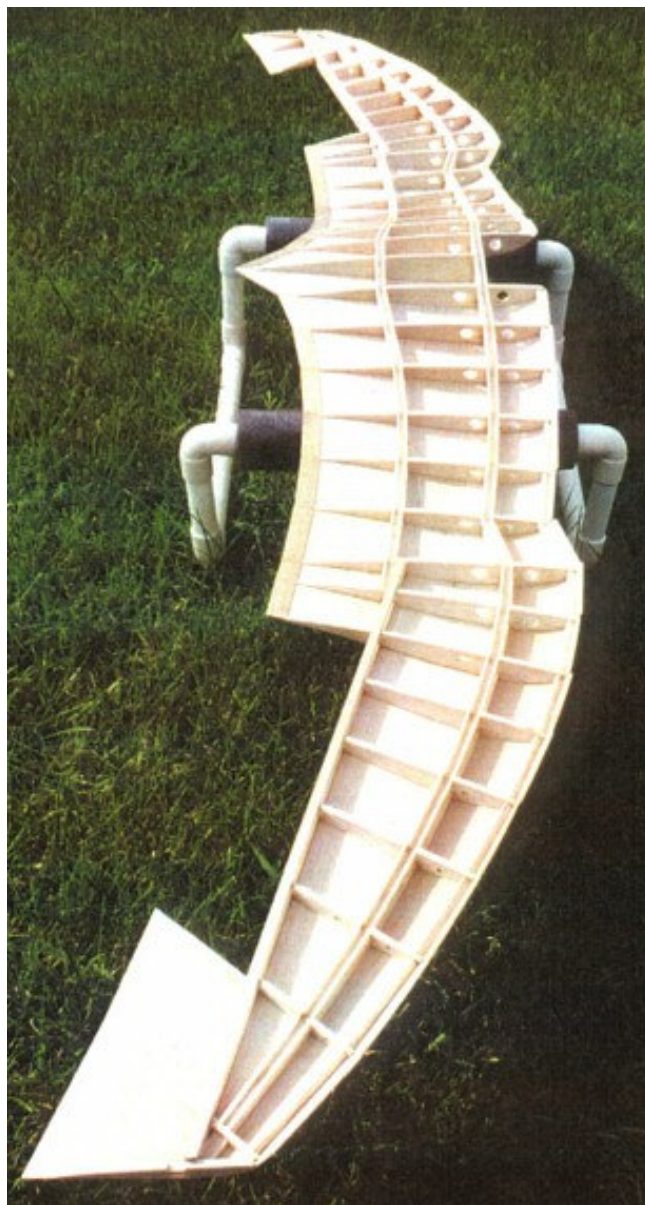
Sheeting: Partial
 Controls: Outboard strip elevons with adjustable reflex

The Coathanger saw developments beyond the Terrier and incorporated a stepped leading edge sweep and gull wing. The ribs were configured to be radial to the leading edge as opposed to parallel to the root. This meant that each rib nose was now perpendicular to the leading edge, which allowed the top sheeting to fit more smoothly. Because of the compound curves of the upper and lower surfaces it was sheeted in sections from rib to rib with the grain parallel to the leading edge, this also facilitated wrapping the sheeting around the leading edge keep an accurate nose profile. Each rib was rescaled so that if the wing were to be sliced through at any point parallel to the root the true section would be apparent. The ribs were cut out with stubs attached to hold each rib at a predetermined height above the building board before fitting the 'U' channel for the carbon tow spars.



The control surfaces top hinged, and a central fin fitted. Whereas the Terrier had an open framework this model was fully sheeted. It certainly had different flying characteristics and spent most of its time gracefully

swooping birdlike along the slope edge, it also hovered very well.

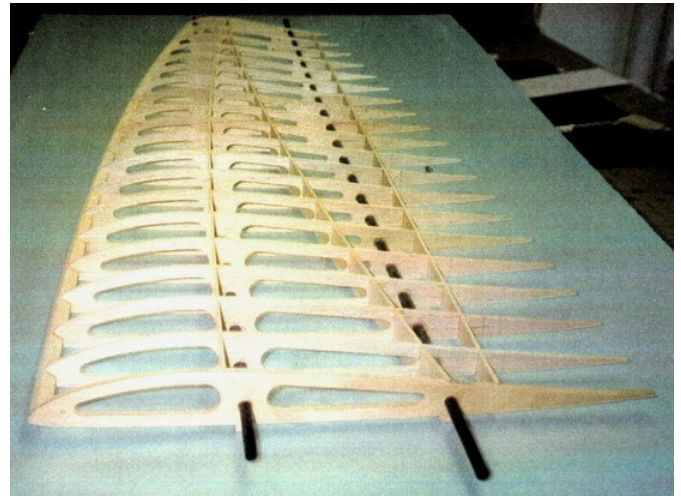


Coathanger Specs

Wing type: One piece curvilinear stepped gullwing
 Wingspan: 1.2 meters
 Section: EMX 07
 Root chord: 250mm
 Tip chord: 100mm
 Spars: Laid up carbon tows
 Sheeting: Full

Controls: Elevons

The Bullhorn is a flat two-piece ellipsoid wing built up around two 8mm carbon tube spars with 6mm carbon rod joiners. Each rib has two locating holes drilled into it and then the rib is slid into position along the tubes. It has full length strip elevons the servos for which are connected when the wings are plugged into the



fuselage. The tips are a sandwich of blue foam with a 1mm ply filling. These have proved to be very resilient and spring back into shape in the event of a mishap. This model has proved to be very stable and easy to handle.

Bullhorn Specs

Wing type: Two piece flat ellipsoid
 Wingspan: 2 meters

Section: EMX 07
 Root chord: 375mm
 Tip chord: 195mm
 Spars: Carbon fiber tube doubling as wing
 joiners
 Sheeting: Partial
 Controls: Elevons

The above models were drawn with TurboCad 7. Drawings and building notes are available if anyone is interested in them. I have just started to use a desktop CNC machine from an Austrian company called Step-Four, which means the days of manually producing ribs is over!! The machine works very well and is highly recommended.

November 14, 2003

Hi Andy,

Rudolf Storck's "Flying Wings"

Although Rudolf Storck's book carries an English title the book is in German and as far as I know no English version is planned for publication.

I obtained my copy of the book from the German branch of Amazon, Amazon.de (see below). I checked both Amazon.com and Amazon.co.uk but they don't list the book in their online catalogue. This Amazon.de site is fully German but has roughly the same lay out as its US and UK counterparts, so it might be possible for non-German reading customers to use the site by comparing the information displayed.

Another option might be the web shop of the Luchtvaart (Aviation) Hobby Shop here in Holland. They carry a very large collection of books and are probably able to order this book from the publisher (I checked their on-line catalogue and they don't have it in stock). The site can be found at: <http://www.lhshop.nl/lhshop.asp>. The site is bi-lingual (English-Dutch) and they have a contact page where they can be emailed. English is no problem. They accept credit cards and ship around the world. (I have no connection with this shop).

Hope this helps. Nurflügel Forever!

Huib Ottens
 ottens@tref.nl

From Amazon.com:

This item is currently not available through our U.S. web site, so you would need to order it from Amazon.co.uk or Amazon.de (German).

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Flying Wings
 Rudolf Storck
 Bernard & Graefe Verlag
 Heilsbergstr, 26 53123 Bonn 2003
 ISBN: 3-7637-6242-6, 464 pages

(ed. – I ordered through the German site and it cost me a total of 61.29 Euros (dollar value changes with the daily exchange rate). After reading the English help areas, I also opened both the English and German versions of the websites. This allowed me to view the help text, compare it to the English version and then make entries in the corresponding German site's fields. This process took about a half hour to complete. The book arrived in about 18 days to California. I know you will enjoy the book.)

(From the Nurflugel mailing list.)

November 21, 2003

Subject: Lippisch P-13a and the DM-1

Hi everybody,

Lately I've been looking at the (very little) material I have about the Lippisch DM-1 delta wing glider, the "flying equilateral triangle" which was supposed to work as a flying qualities testbed for the P-13a, a supersonic (!) ramjet powered (!!) coal burning (!!!) interceptor of equally triangular shape (take a look at the Nurflugel website for some pics).

Those designs have always made me curious: what was Dr. Lippisch's rationale behind those? In other words, what the heck was he thinking?! The same designer behind the Me163 MUST have a good reason for that... In spite of the 60 deg leading edge sweep, airfoils were 16%-plus thick.

Does anybody has any idea about that, or can recommend references?

Thanks,

Andre
almartins2000@yahoo.com.br

November 21, 2003

I too have wondered why the DM-1 had such a thick root airfoil. The only thing I can think of is that it was intended as an un-powered glider and he figured a thick section would be appropriate for the speeds it would fly at. The large internal volume of the earlier "Delta" series was recognized as one of the advantages of a triangular wing but certainly he wouldn't have tried using such thick wings for the high-speed plane.

I don't have his 1946 paper on highly swept wings anymore so I can't look up the specifics but, as I recall, the DM-1 was scaled up from a low Reynolds number wind tunnel model. The low Re model with blunt leading edges was the first plane to develop leading edge vortices and hence the vortex induced high lift.

When the full size DM-1 was tested after the war the enhanced lift of the low Re model didn't materialize and in fact the full size DM-1 had a tip stall problem. Lippisch realized that the high Re flow wasn't separating from the blunt LE at the root like the low Re flow had. To force separation at the root he made the LE sharp there and to prevent the tip stall he made the LE at the tip drooping and more blunt (isn't that called

"conical camber"?) Anyway the modifications to the LE worked and you can see the influence of the DM-1 experiments on the F-102.

<http://www.lib.iastate.edu/spcl/manuscripts/MS243/DELTA.html>

There's a lot of stuff including several that mention swept wings but I believe this is the one with the DM-1 results: 20/8 Bureau of Aeronautics Technical Intelligence Liaison Unit -- "Swept-back Wing." 1946

Norm Masters
nmasters@acsol.net

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, 8 1/2 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 3 1/2+ 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"

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