

T.W.I.T.T. NEWSLETTER



This is the Horten H 1B , LV-X017, in restoration in Club de Planeadores Otto Ballod de la ciudad de Adolfo Gonzales Chaves, Argentina. Provided by: Hugo Sirtori

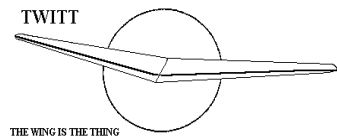
T.W.I.T.T.

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., 0802 means this is your last issue unless renewed.

Next TWITT meeting: Saturday, March 15, 2008, 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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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

While we were doing the master cleaning project at the hanger I ran across a box of slides that Bob Fronius has taken back in 1991. It turned out they are slides of pictures he had gotten his hands on, probably from Don Mitchell. They are of the Bowlus twin boom test bed, an early Mitchell wing without the booms, and a bunch of other Mitchell shots where he was working on various projects.

I will get busy and scan all of the good ones into image files and post them on a new page on the web site. I think most of the older ones of test flights out on the dry lake bed have been around for years, but I wouldn't know exactly where to go to find them anywhere on the Internet. So hopefully, this will provide the necessary repository for them to get further exposure to the newer flying wing enthusiasts.

I will be changing the user ID and password for access to the members only section of the web site. It has never been updated since I created this section and we have had a number of members leave the group so it is time to make the change so the newsletters aren't accessible to non-members. In the future I am going to try and make sure to change the ID and password the first of each year. I know that not many of our members who receive the printed issue must use the web site, since no has mentioned no being able to see the January 2008 issue, which I haven't published there yet.

Hope everyone is having a great year so far.



**MARCH 15, 2008
PROGRAM**

The March program will feature Christopher Alan who will do a presentation on the Ligeti-Stratos joined wing design. The all-composite, joined-wing, ducted fan Ligeti Stratos was originally conceived in 1982 by Charles Ligeti, of North Balwyn, Victoria, Australia. The designs



for the second generation will be released as Open Source through this web site, and development will continue and expand through a community of skilled collaborators, enthusiasts and individual builders who

are interested in contributing to the fulfillment of Charles Ligeti's original vision of a compact, super-efficient, high performance personal aircraft. You can see more in this aircraft at:

<http://ligeti-stratos.com/concept.htm>



**LETTERS TO THE
EDITOR**

January 13, 2008

(ed. – This was in response to a request for an updated e-mail or snail mail address for Mark dePolenc. If anyone has this information could you please forward it to Bob at his e-mail address below.)

Andy, thanks for your reply.

My last successful contact with Mark was by E-Mail about 3 months ago when he was commuting to the Indonesia area. I even tried to call him at his home phone only to get a "disconnected" message.

He publishes/advertises one of my popular books and they haven't been coming through.

Bob Recks
<r.recks@juno.com>

January 16, 2008

Hello TWITT:

I was interested in buying the A.R. Weyl Compilation book offered by Serge Krauss.

I sent two emails to Mr. Krauss, both failed. Copy attached. Can you tell me if the A.R. Weyl Compilations is still available and if Mr. Krauss can call me sometime or you can forward this message to him.

I am thinking of purchasing the book about flying wings. I am especially interested in low aspect airplane design and flying wing controls.

Since you are familiar with this subject and have reviewed or compiled this information, have you seen an elevon control mixer that looks like an "A" that pivots in pitch where the center or cross/horizontal hinges and torques for roll? Is there a drawing like this in the book?

Thank you,

Stephen Sawyer
Lincoln, California
<s-sawyer@sbcglobal.net>
916 645 - 8494 (eves best)

Stephen:

Andy (TWITT) forwarded your e-mail to me; I guess we missed that change in the newsletter. I sold all the A.R. Weyl compilations several years ago, but can take a few hours to make up some more, if there is some interest. Andy said that he'd be happy to place a notice in the next newsletter to see if and/or how much interest exists. At about that time, I could place a notice on the "Nurflugel" list. Then, if there are a few requests, I'll know how many to copy and bind.

It's a bit labor intensive, since the masters were made from bound copies of Aircraft engineering at the Cleveland library, and pages could not all be centered properly. I have to print two-sided while placing each page differently on the copier window. Then there's the collation thing and packaging for mailing - not particularly fun. So I don't want to make a career of revisiting the copy place. However, I'll be happy to do so, when I know how many to make, because it's really a nice series, and I'm happy for everyone to have this educational piece of history.

So, let me know whether this is satisfactory for you. I believe that there will be a few folks interested.

Serge Krauss
skrauss@ameritech.net

(ed. – I have updated Serge's e-mail address on the web page dealing with the Weyl papers so this shouldn't happen again.

So, for any of you who might be interested in these papers please let Serge know directly through his e-mail or snail mail address you would like a copy. The link to our web page for this is:

<http://www.twitt.org/WeylCompAd.html#top>

January 18, 2008

My name is Kent Decker. I am an aerospace engineer specializing in spacecraft power systems. I have developed the concept for a high altitude solar powered UAV with energy storage that can stay aloft for an indefinite period of time. Goal is greater than 5 years. I am thinking that a tailless aircraft will provide the least amount of drag. Is there someone in your organization that can help me with the wing design? Are there textbooks or literature that can help me with the wing design?

Thanks,

Kent
< sportsdeck@roadrunner.com >

(ed. – I sent this information request to Phil Burgers thinking he could provide a more direct response to both the design and reference books. If anyone else would be interested in seeing what Kent has on the drawing board and could provide assistance.)

January 22, 2008

Good day. I am an avid unusual aircraft enthusiast, namely both flying wings and tilt-rotor aircraft. I fly aboard the V-22 Osprey in flight test, and have designed and built a handful of tailless flying models, most recently a Zagi-like RC wing. I'm also an SFTE and AOPA member. I was wondering if I am still able to join your organization. Thank you in advance!

Brian Link
christopher.link@navy.mil

(ed. – I replied to Brian with an explanation of what membership would bring and wrote back with the follow, however, I haven't seen a payment come in yet.

Andy:

Thanks much, and I will get that payment enroute ASAP. I understand I can do it through PayPal. I don't know if I would be able to contribute much being out here in Maryland, but who knows, maybe I'll make some kind of breakthrough on my research I can share! Thanks again! -Brian)

January 25, 2008

Hi Andy:

Have you received "UNBELIEVABLE"? If not, I will send it again via post or E-mail, whichever you prefer.

By regular mail I have just sent you another minor contribution "IS THE MITTENEFFKT A MYTH?".

Additional material will be e-mailed in the next few days:

TWITT NEWSLETTER must continue! Keep going with your nice job!!

Regards.

Ferdi Gale'
< ferdigale@alice.it >

(ed. – As you will see later in this issue I have received the Mitteneffekt article along with some illustrations.

As you can also see I got the "Unbelievable" piece and has included it.

My thanks to Ferdi for his many contributions. It makes putting the newsletter together when I have choices for what goes in each month.)

January 26, 2008

I am wondering if you have any film footage of any of the Horton aircraft in flight.

Thanks,

Michael Jorgensen
<michael@mythmerchantfilms.com>
Myth Merchant Films
MythMerchantFilms.com

(ed. – I wrote back that we don't have substantive film of any Hortens in flight. About the only thing we have is a very short clip of the Horten IV behind a Stearman on tow in Texas. I know there has to be more footage

out there that was made by Germany during aircraft development, but it would sure seem that it has all disappeared unless it's in someone's personal collection.)

January 30, 2008

This is the Horten H 1B , LV-X017, in restoration in Club de Planeadores Otto Ballod de la ciudad de Adolfo Gonzales Chaves, Argentina

Hugo Sírtori
<hugo@kayaksmeridien.com.ar>

(ed. – There was on other picture included with this submission. It is the control stick configuration, which might be close to what Stephen Sawyer is looking for. It seems very simple, but you can't really see if there are any associated rudder pedals.)



January 31, 2008

Hello Bob. Love your bird models. I have your plan for the Turkey Vulture and have yet to build it. Might try to have it ready for Soar Utah this September.

I have some questions about designing birds: I assume the structure for all your birds is basically the same with the exception of the wing-tip controls. On the seagull and pelican, did you place the wing servos next to the body as you did on the vulture? I would think the complex dihedral/annhedral/swept spar would make it difficult to run a carbon rod from the fuselage to the wing tip. How did you do it? Was the servo placed at the outside wing beak?

Did you use the same airfoil for all your bird models? I am considering designing a albatross with a conventional structure (wood). I think that the basic structure of the vulture might work. I would redesign the wing to be a two piece affair for transport. Also, I would like to keep the wing-tip controls like your birds and not use ailerons. Are the twisting wing tips on your seagull effective?

Thanks for reading this and thanks for your time. Regards,
Jeff Meskey
SSA Utah
<Jeff.Meskey@SSAMarine.com>

(ed. – The following was Bob Hoey's response with some added pictures.)

Hi Jeff,

You sound like an "experimenter" like me. An Albatross should be a good, but challenging, project. I can probably give you some tips that will help out.

First I'll answer your questions directly. Yes, the basic structure is the same for all, except for the wing spars, which I'll describe later.

The Seagull has servos at the wrist joint, and carbon torque rods from there to the tip aileron (like the vulture). It works OK, but goes against the desire to keep the wing inertia as low as possible (to keep the roll oscillations down).

The Pelican has the servos at the center section of each wing with a standard, flexible push-pull tube that operates a bell crack near the tip. That is what I would suggest for your Albatross. There is a little more slop, but it works just fine.

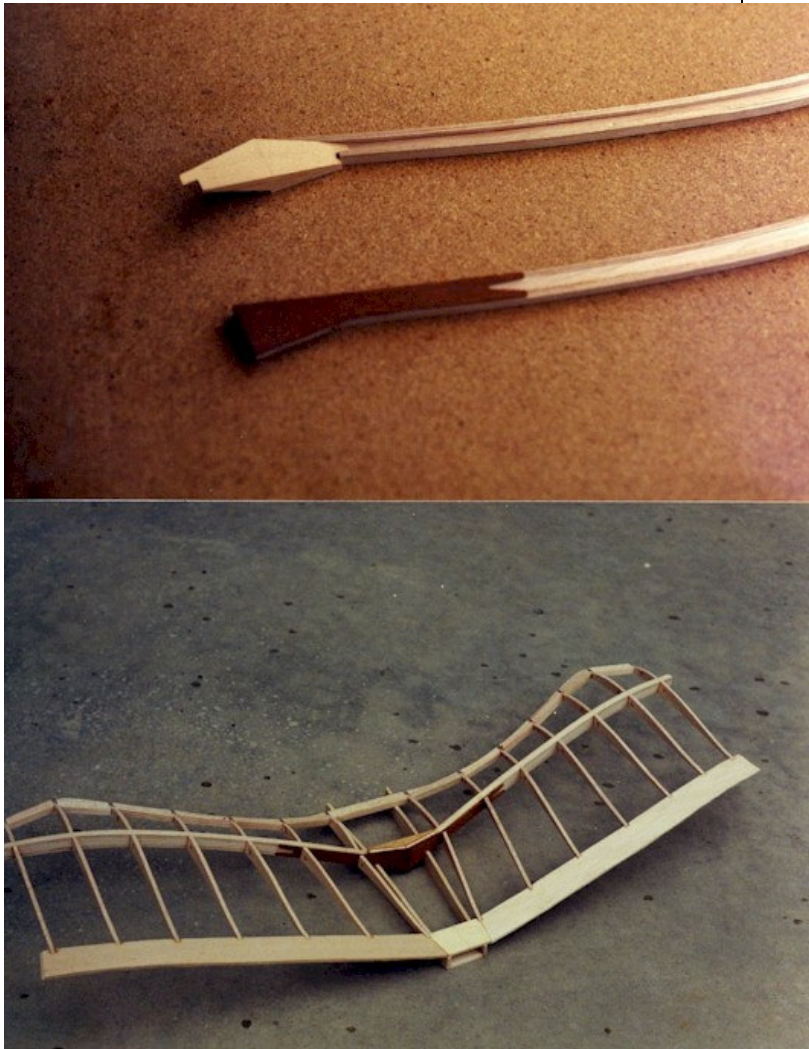
Until recently I have used the same airfoil for all the birds - under camber with reflex at the trailing edge. It works well for low speed thermal soaring but the under camber provides a lot of drag at higher speed. I recently tried an airfoil that has the same upper surface as the Turkey Vulture model, but the bottom surface is flat between the leading edge and the forward edge of the trailing edge piece. This removes the under camber, but retains the reflex at the trailing edge which is necessary for pitch trim. It flies just fine and seems to have better penetration at higher speed. Should work OK on the Albatross. (which, of course, is a pretty high wing loading, fast bird).

I agree with a 2-piece wing for transport, and also to allow you to change the dihedral by bending the connecting plate or tubes.

The seagull tip ailerons work just fine and will allow you to select a trim bias position that will

eliminate adverse yaw that you would get from ailerons.

Now some suggestions;



(1) You should probably build in 3 or 4 degrees of washout in the outer wing panels outboard of the wrist joint. (I have 4 degrees on the Seagull) The "sweet spot" for the seagull model is with the tip aileron at a -7 degrees incidence with respect to the wing center section. (best coordinated turns)

(2) The wing spars for the Seagull and Pelican were built up as follows: The main spars (full depth) were cut from a sheet of 3/16 (or whatever, balsa) to the shape of the wing dihedral (front view). A 1/16" by 1/4" cap strip was glued to the top and bottom of the spar.

A strip of .007" by 1/4" carbon ribbon was glued to the 1/16" cap strips. When the structure is completed, the wing is sheeted, top and bottom, with 1/16th sheet balsa forward of the main spar to the leading edge. This traps the carbon ribbon between the cap strip and the sheeting which produces a very strong, lightweight "D" spar wing and helps retain the complex dihedral shape over the span of the wing.

A little bit complex, and very difficult to build without warps, but no one said it would be easy!!

All birds are pretty short-coupled in pitch- especially the albatross. And it doesn't have a very large tail. The reflex in the wing airfoil will be pretty important to allow you to trim it.

I have found that starting with the little round disks (mounted near the wing trailing edge, angled in about 20 degrees) helps to provide some level of directional stability during the early flights. The final tweaking (eventually eliminating the disks) should be done by adjusting the total wing dihedral. It only takes a couple of degrees to change from an unstable airplane to a marginally stable, but nice flying model.

I have attached some photos to help with the above comments. I have photos of the construction phase of the Seagull and Pelican model, but they have never been published.

If I can help in any way, let me know, and by all means, let me know how your Albatross flies!!

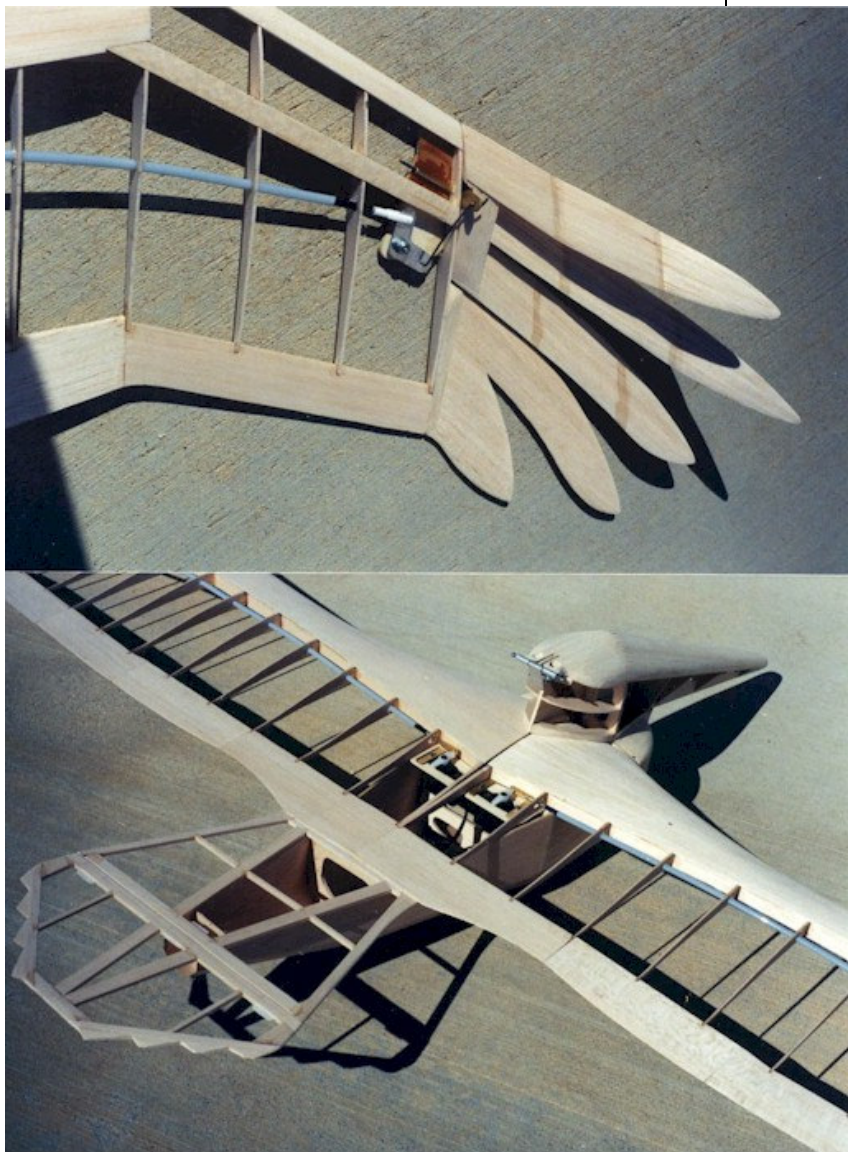
Bob Hoey

<bobh@antelecom.net>



Thanks Bob the photos and text explain a lot!
 Regards,
 Jeff Meskey

Vincent Morin
 20 rue du Fromveur
 29200 BREST
 FRANCE
 <vincent.morin@univ-brest.fr>



(ed. – Can someone give me an exact translation on what is being asked here. I am assuming he is looking for Horten PUL-10 plans or more information on this design. Thanks for your help.)

UNBELIEVABLE !!!

An unbelievable incident happened to the Horten brothers during WW II. They were ordered to send all their tailless sailplanes to the Braunschweig aerodrome, which had not been yet bombed by the Allies. Two planes needed some maintenance: then they were shipped to the Peschke factory, where other Horten aircraft had been built and repaired. The two tailless arrived with each semi-wing cut into two pieces, in order to load them onto the short railway wagons.

Somebody had thought that the pieces, being wooden construction, could be easily glued together again.....No comment! The attached cartoon, which renders the incident, has been drawn by the Italian *old-timer* modeler Carlo Turbino of Genoa. (From the book "Tuttala Horten", (Horten Talless)).

In this context, old-timer means a guy who was fumbling with flying models before WWII, like the author of this note.

Ferdi Gale
 Baveno VB, ITALY

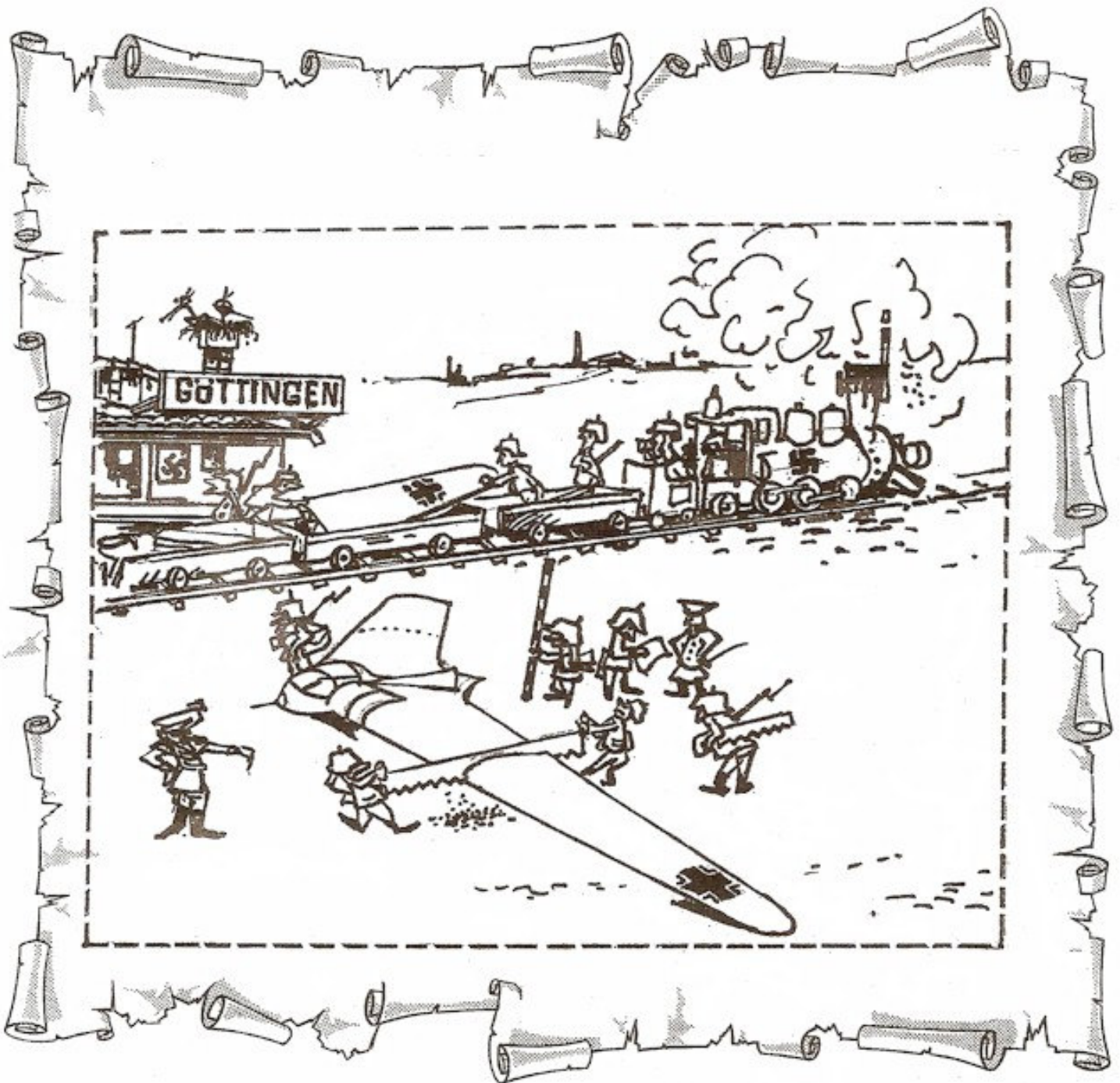
February 3, 2008

Bonjour,

J'ai par hasard vu que vous cherchiez en 2001 des plans d'aile volante Horten. Je suis aussi intéressé par la construction d'un PUL-10 ou assimilé. Avez vous trouvé une source pour des liasses de plans d'aile de ce genre ?

Merci des informations que vous aurez la gentillesse de me communiquer,

(ed. - See the top of the next page for the cartoon that goes with this tale.)



IS THE “MITTENEFFEKT” A MYTH?

By Ferdi Gale’

Many papers have been written on the Horten tailless theory. According to some of them, at the centerline of the swept back wing there is a decrease of lift, with all the related drawbacks. The Horten brothers named this fact “*mitteneffekt*” (“*middle effect*” for English speaking people) and were confronted with it during all their aeronautical career. According to some later critics, the “*mitteneffekt*” is just the result of the system the brothers used for their

calculations, but not a real thing. Many tailless fans don’t share this opinion: let’s see why, with the help of FIG.1. The upper part of this illustration (A) is taken from the book FUNDAMENTALS OF HYDRO- AND AEROMECHANICS, by L.Prandtl and O.G.Tetjens (Dover editions, 1957). As we know, Prandtl is the founder of the modern aerodynamic science. The above illustration shows that the airflow is oriented *outwards* on the top of the wing, while it tends *towards* the centerline on the bottom. At the wing tips the orientation of the two airflows generates the well-known tip vortices, which create additional drag. If we change the plan form, creating a swept back wing, this

phenomenon does not disappear at all (B). In both cases the flow deviations begin at the wing centerline. The pointed nose of the wing (B) cannot but increase the flow deviations, a supposition which looks quite logical. Hence an additional increase of turbulence and a decrease of lift.

Or am I wrong?? In order to minimize the "mitteneffekt" the Horten brothers experimented two ways: 1) increase the sweep angle at the leading edge in the central panel of the wing: this creates a kind of cuspidal nose; 2) increase gradually the chord in the very same central panel, thus obtaining a cuspidal tail (sometimes mentioned as *Horten tail*).

One H-II was modified, in order to test the airflow around the inlets of dummy engines (upper FIG.2). The same concept was adopted for the single engine fighter H-X (lower FIG.2), as well as for multiengine transport tailless (never built). Perhaps the most significant example of the *Horten tail* is the elegant H IX (built in several versions around the end of WW II): see (FIG.3). Apart from the undeniable aesthetical point of view, the cuspidal tail offers an additional advantage, at least from a modeler's viewpoint: the aerodynamic *center AC* is moved a little bit rearwards. Thus also the center of *gravity CG* can be moved a little bit.

The ballast, that modelers very often have to place in the nose, can be reduced. Needless to say, the entity of these changes can be assessed only on a case to case basis, since we are talking about very small quantities (that is millimeters).

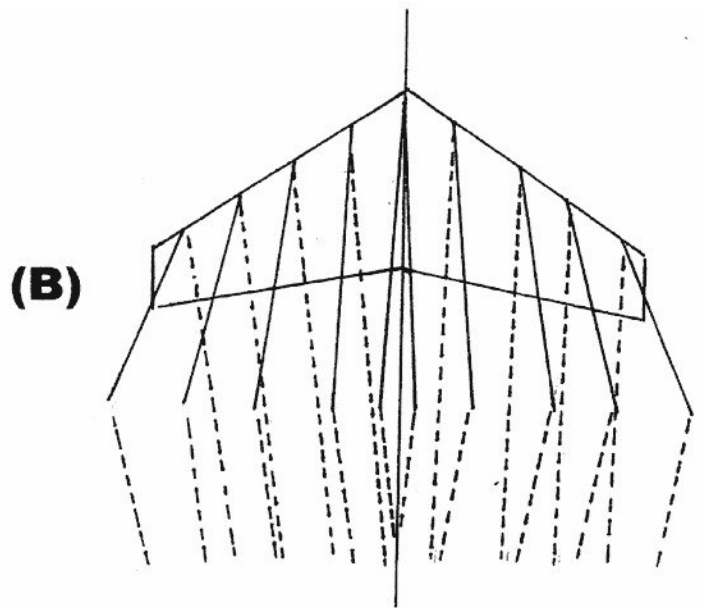


Figure 1. Lower image.

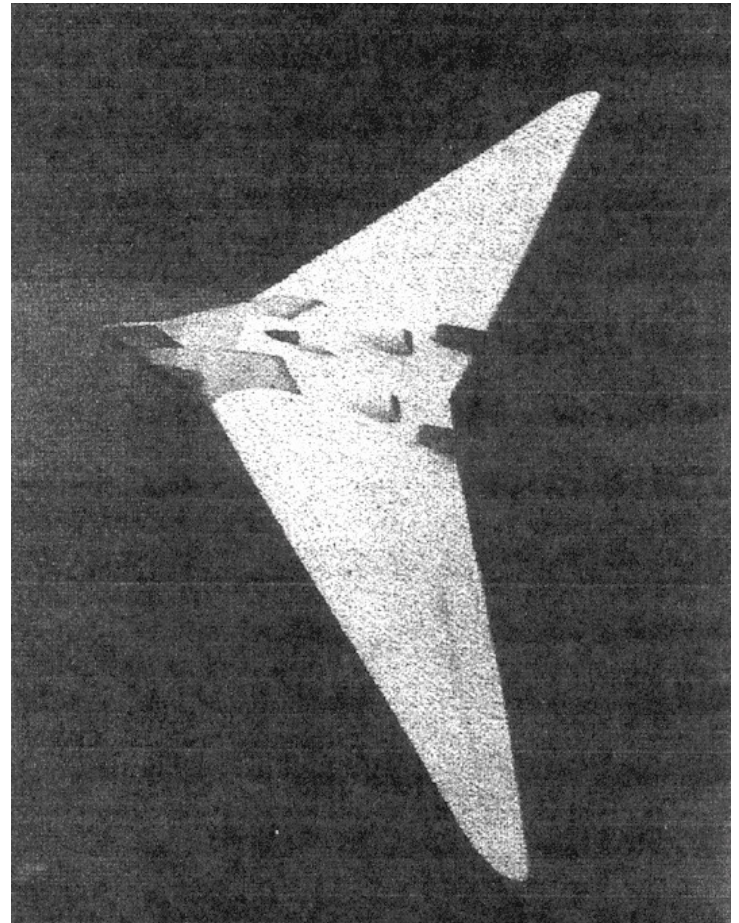


Figure 2. Upper - The H-II with the H-IX nose configuration.

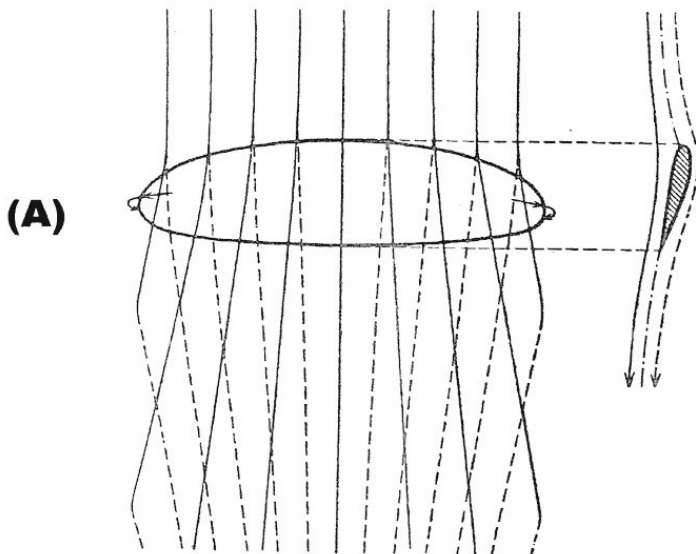


Figure 1. Upper image.

Extracted from the Nurflugel Bulletin Board:

After doing a quick search, it appears "Tailless Aircraft, in Theory and Practice" is now being printed "on demand" in the UK.

Check this link although that source says it has just two copies left.

<<http://www.amazon.co.uk/exec/obidos/ASIN/0340614021/ref=nosim/bookfindercom01>>.

Bill & Bunny Kuhlman

My friend Gustavo Lucero has built scale model of a motor powered version of H-Xb --it is no longer a "Piernifero" ;-))

Last Sunday we made a successful take off, the craft flew with good control from the beginning, I was so surprised to see it in the air that could not operate the zoom of the camera -- hope to make better videos later.

Here I send a link to two videos and some pictures <http://www.miliamperios.com/foro/viewtopic.php?t=93909> Gustavo Lucero is the guy in the center.

In the text, it is explained that the craft is made in the 1/5 scale, 2 meters (6.56 ft) span, it flew on Sunday 13th and tests had to be stopped due to excessive wind so as not to risk the craft. The final goal is to build a full sized craft.

This model weights 2900 gr (6.39 lb) and is powered by Glow 40 piston engine.

In the pictures below, I'm standing with the 1/5 scale aircraft in my right hand, still uncovered and with no engine ; and in my left I hold the 1/4 scale model of the H-Xb Piernifero. The arrow in the trailing edge is because of an error in the measures we made... it should have been straight like the other.

We hope to make new flights soon.

We are preparing for a new test using a better video camera.

The little craft took off in a crosswind (as can be seen in the video) apparently floating in an air cushion caused by its shape, (the ground was very rough, could not have allowed such a smooth run), with remarkable directional stability and control. It all surprised all of us. The take off was because of a little bunch of grass that hit the front wheel. The craft survived well the landing, with minor damages caused by ground obstacles.

Greetings from Argentina

Fernando Walter Siarez

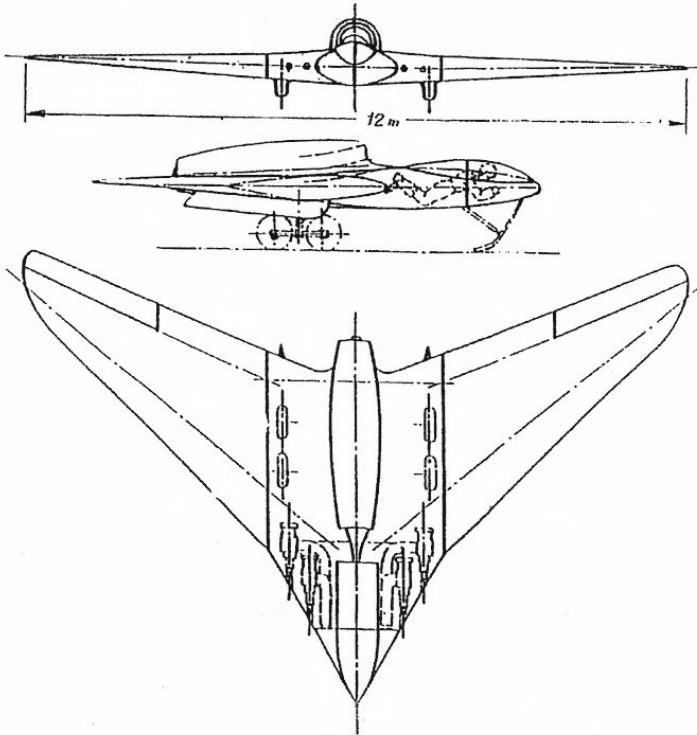


Figure 2. Lower – The H-X Fighter project.

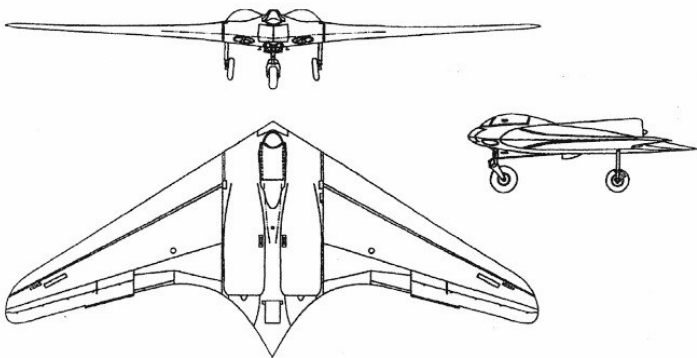


Figure 3. Upper – H-IX V1-A twin engine fighter.

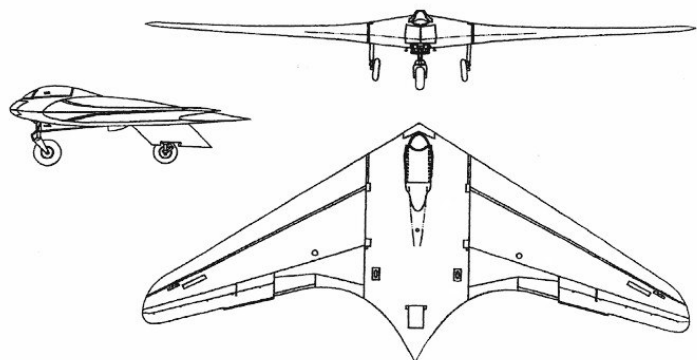


Figure 3. Lower – H-IX V1-B experimental sailplane.

Engineering Prints

Went to the Munich Archives yesterday, a cool place. I signed out the 3 cans of microfilm with the GO-229 blueprints. There are a lot of prints on a roll of microfilm. They were fascinating to look at, airframe, fuel systems, electrics, etc. Found one with wind-tunnel numbers on it and the airfoil being slightly angled up and down to demonstrate airflow. I printed a few I liked, but there were so many, if I wanted to build from them, I would need a few days to just figure out what to copy.

The people were very helpful and showed me the viewer-printer, yes, it copies as you read, never seen one before, but I'm not a serious archive reader unless it's something really neat.

I also saw the V2 rocket book (1 of em) and now see how the nozzle steering worked, a rudder in the rocket stream, basic, but as it was one-way, it'll do pig, it'll do.

The ME-262 Schwalb was there too, nice drawings. The Jumo-004 and 4B were shown along with the internal parts in section.

Like I said, you need a week. If anyone wanted something looking up or printed, next time I go I could check if its there. I'm not a aerospace engineer, so it will have to be a dead simple description. Anyway, just FYI.

kwtaber@hotmail.com

Any Further News Release On The Horton Aircraft H3000

Prior Comment: "But for the flying wing design to be validated as a powered airplane for >general aviation we need a capable kit/plane. It appears the person behind these pics has come the closest to a personal flying wing."

I don't know that we need a kitplane to validate a design. There have been numerous successful powered, light tailless planes, some of which have been marketed in plan form and built by others. I'm not sure whether you are confining consideration literally to "Nurflugels", that is, All-Wing aircraft, but there have been many successful powered tailless types, including several powered all-wing types by the Hortens themselves. Some of these have demonstrated practicality for general aviation. The PUL-10 folks' are apparently still working on getting their basics just right.

Aside from powered Horten designs that flew regularly with success, there have been numerous others (like powered SWIFT, Backstrom WPB-1,

Beierle, Betteridge "Hornet", Ford Motor Co., Granger Bros., Lee-Richards, several Soviet planes, Lobelle, Perkins, Schapel, etc., etc.) that flew regularly, but probably lacked sufficient utility or simplicity to fit the role envisioned here, or whose safety remains unverified. Here are a few successful tailless planes that may have proved practical for general aviation use (starred items are planes I'm pretty sure to have demonstrated speed and range, at least for their eras):

Single-seaters:

*Marion Baker: MB-1 "Delta Kitten" - designed as PoC for F-1 racer, but flown regularly as sport plane, ca. 1960.

*Lowell Borchers: "Delta Sting Ray" (Mini Dyke Delta derivative), 1969.

*Curtiss/Smith: "Arrowhead Safety Airplane", 1930.

*Gilbert Davis: "Starship Alpha", 1986 (2-place version designed, but not completed)

*Charles Fauvel: several, ca. 1934 - 79 and thereafter (plans sold).

Milt Hatfield: "Little Birds" # 1-3 (single-seat ARUP types, 2 in UL category - fuselage molds for production), 1986-92

C. Ligeti: "Stratos", 1985

Alexander Lippisch: several, ca. 1929-39

*F. Mihail: "Stabiloplan IV", 1933

N.R. Payen: several, ca. 1954-

Ulrich Schafer: "Project Aachen", 1995

E.S. Winton: "Facet Opal", 1989.

Verhees: Delta, 2004.

Multiple seats:

*J.W. Dunne and Burgess-Dunne aircraft, about 20 of which flew, 1911-16.

*John Dyke: "Dyke Delta", 1960-present (4-place cross-country plane; plans still available, several built, original still flying)

*Charles Fauvel - several, ca. 1934 - 79 and thereafter (plans sold).

*Raoul Hoffman: "Hoffman Flying Wing", 1934 (also designed Snyder ARUP's #2,4)

*W.E. Horton: "Wingless", ca. 1952-4.

Lewis Jackson, "Roadable" or "RA-7", ca.1964

A. Lippisch: several ca. 1929-39

Rohr Industries (Mooney, Chana, et al): "Two-175", 1974 (side-by-side shrouded delta, required special landing technique)

*Snyder/Hoffman: ARUP's #2, 4, 1933, 1935 (extremely reliable and successful, flew all over midwest and Washington DC)

*Alexander Soldenhoff: several, ca. 1928-32

*G. Spratt (Sr. and Jr.): various "Control-Wing"

variants, ca. 1937 - 73 (for semi-tailless types; plans-built planes flew)
 William Stout: "Batwing", 1918, *Stout-Spratt "Sky-Car IV", 1946.
 B.I. Tscheranowski: various, 1924-48
 *Barnaby Wainfan: FMX-4 "Facetmobile", 1993-present?
 *Waldo Waterman: "Arrow Plane", 1935; "Aerobile", 1937, 1958 (roadables; transcontinental flights and drives on highways)

Unknown (to me) Utility:

Planes by George Briffaud, ca. 1955-84 and a ton of others.

I had a problem with "practicality", since standards of range, speed, capacity change with era and may not be agreed or known. I starred those that had some speed and range for their time, and whose concepts I feel to be adaptable to present technology.

This one is a definite ":FWIW".

Serge Krauss
 <skrauss@ameritech.net>

AVAILABLE PLANS & REFERENCE MATERIAL

Books by Bruce Carmichael:

Personal Aircraft Drag Reduction: \$30 pp + \$17 postage outside USA: Low drag R&D history, laminar aircraft design, 300 mph on 100 hp.

Ultralight & Light Self Launching Sailplanes: \$20 pp: 23 ultralights, 16 lights, 18 sustainer engines, 56 self launch engines, history, safety, prop drag reduction, performance.

Collected Sailplane Articles & Soaring Mishaps: \$30 pp: 72 articles incl. 6 misadventures, future predictions, ULSP, dynamic soaring, 20 years SHA workshop.

Collected Aircraft Performance Improvements: \$30 pp: 14 articles, 7 lectures, Oshkosh Appraisal, AR-5 and VMAX Probe Drag Analysis, fuselage drag & propeller location studies.

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



VIDEOS AND AUDIO TAPES



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

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 Aeroenvironment 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 Aeroenvironment'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

COMPANION AVIATION PUBLICATIONS



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