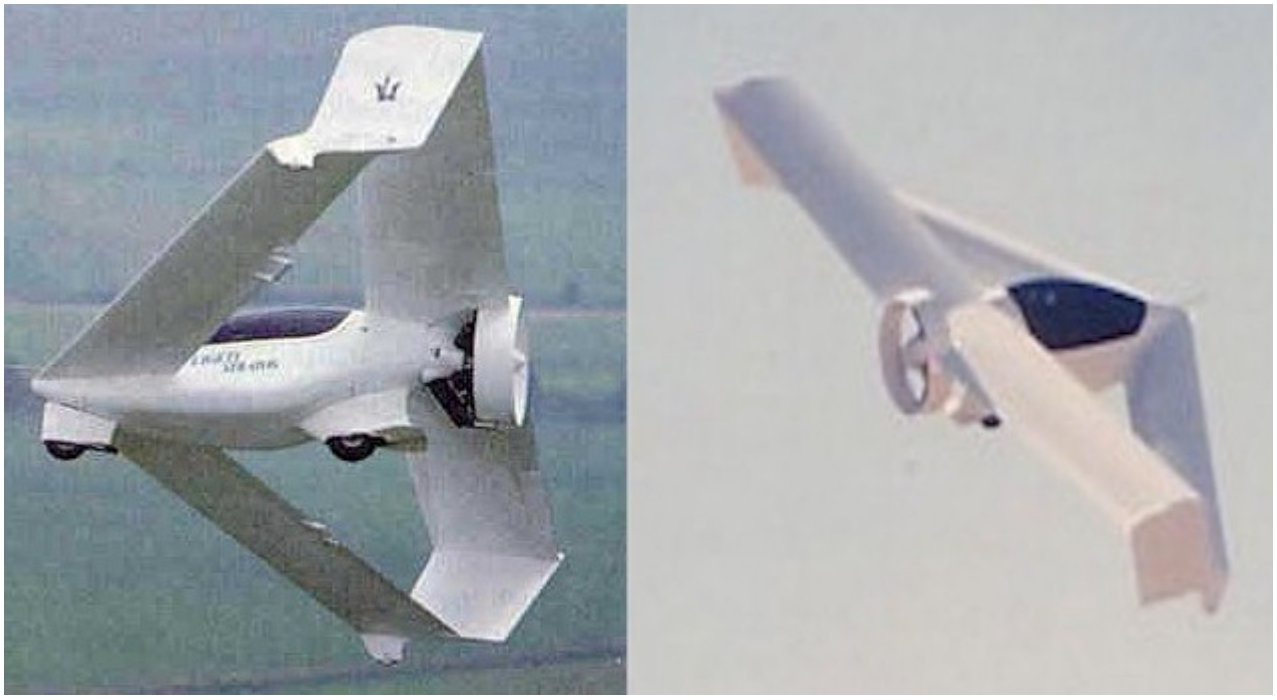
No. 262 APRIL 2008

T.W.I.T.T. NEWSLETTER

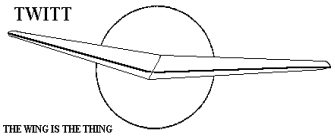


Ligeti-Stratos – See more about this design on Page 2.

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., **0804** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, May 17, 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

It was great to have a real meeting in March and I hope you get something out of the recap. We had a nice size group that was active in asking questions of Chris Alan on the Ligeti-Stratos project. I think he got some ideas from the audience on what questions he should be asking going forward, especially with regard to engine selection and aerodynamic issues.

There was also a good thread on the both the Nurflugel and U-2 Bulletin boards this past month that I have included in this issue. The Nurflugel board gets a little off topic sometimes, but every once in a while they actually discuss things relevant to flying wings. Jim Marske is a participant and he has included some remarks on wing swept as it applies to flying wings. It is a good read.

After doing some further calculations it looks like the one-cent increase in postage isn't going to have any real affect on our finances. With the current membership renewals we have a stable balance in our checking account, so we are in good shape until the USPS makes another major fee increase in the future (we know it is all coming eventually).

As of right now I don't know of any prospects for a May program, but will keep my ears open for suggestions. Last month was started by Phil Burgers, so hopefully someone will come across a good subject with a speaker who lives in the southern California area.

Andy

MARCH 15, 2008
MEETING RECAP

We were pleased to welcome Christopher Alan to the meeting for his presentation on the Ligeti-Stratos joined wing design.

Chris started by explaining a little about his background and how his involvement in the Stratos project got started. He is a software developer specializing in Internet search engines, with no experience in building airplanes. This will be his first project and a challenging one at that. The one advantage is that the aircraft had been built and flown for over 700 hours, so there are some known factors that they can work with and incorporate into any re-engineering that becomes necessary.

When he decided to get involved in a project he started looking around for something interesting and found the Stratos through a web search. He decided on this unusual, joined wing, pusher, ducted fan aircraft. He also found it very visually appealing.

The story behind the original aircraft and its designer also intrigued Chris. Charles Ligeti was an Australian naturalized citizen of Hungarian descent. Although there was some aircraft design experience in his family, Ligeti was self-taught, which meant he wasn't bound by some conventional wisdoms of more traditional designs, but also meant he wasn't quite as disciplined as an engineer.

Ligeti's design goals were similar to those of Chris' for a personal aircraft, very small and be able to fit into a single car garage for the average builder, as well as be trailerable to the airport. Ligeti wanted something strong, light weight and with good performance capabilities.

At this point Chris started through a series of pictures including the one below showing Ligeti and his wife at Oshkosh sometime in the late 1980s and won a design award for it.

(No he didn't fly it from Australia, but did ship it on the trailer via a 747.)

It was noted how small the aircraft looks in this picture. Chris commented that at this size in it very efficient reportedly only burning 1.3 gallons per hour at about 112 mph, using a 3-cyclinder Konig engine. The engine is not something that Chris thinks will be on his version, but he hasn't found just the right option yet.

There were two version of the aircraft built. The first one had a reduced aft fuselage section that allowed unrestricted airflow to the ducted fan. The second version had an extensively modified aft section to redirect the airflow that unfortunately also made some changes to the stall characteristics.

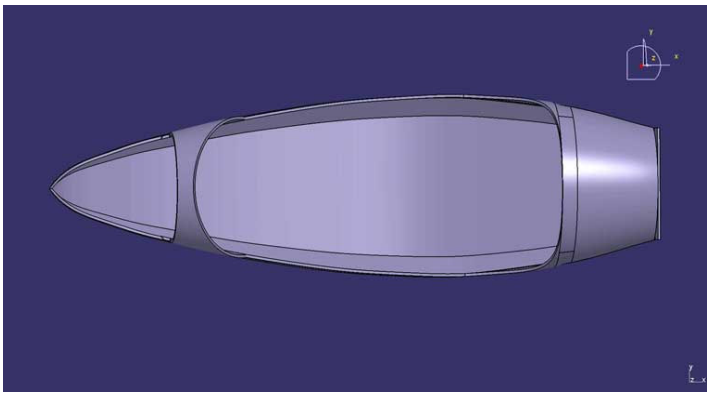
This is the first aircraft with the smaller area aft fuselage that gives good airflow access to the front of the ducted fan. The second version extended the bottom of the fuselage back further with a strake like structure that apparently reduced airflow to the engine at high angles of attack and may have been a contributing factor to the aircraft's crash.

Ligeti started with a prototype glider as shown below. The upper wing has 3 degrees of dihedral. The picture above also gives you a good look at the shroud around the propeller blades. The shroud was all hand crafted, and apparently never had any problems with interference of the nylon blades.

Although not clearly evident on the picture above, there was also a gravel deflector at the base do the lower vertical fin. *(A later CAD drawing will make this*

feature clearer.) They flew out of a grass stripe most of the time and had to prevent the small rock and stones from hitting the nylon blades that were very sensitive to such abuse. This was also one of the reasons for developing the revised aft structure to funnel clean air to the ducted fan that turned out to be very problematic.

Chris discussed the fuselage structure and its ability to withstand crushing and indicated it would be something he would work on as part of the re-design. Ligeti was a smaller man and the cockpit was okay for him but not wide enough for a typical pilot. The CAD drawing below gives you an idea of how the cockpit section could be widened to accept a wider range of pilot sizes.



The design goal of having the aircraft fit on a trailer was realized as seen in the photo below. With a fuselage length a little over 8' it had to be put on a slant to reduce trailer width to less than 8' to meet US highway standards. This is very similar to the way Jack Lambie trailered his Fauvel with it standing slightly on its nose after pushing the wings into cradles and rotating them up. The nice thing about it is there is no setup time when you get to the airport, since you just put in on the ground, pre-flight and go.

You can see the nose wheel strut in the photo below. Chris noted that this also served as a small rudder in the air and was actually an airfoil shape for that purpose. It was said that the aircraft could turn without banking and that you could control pitch through use of the flaps. You can also see the small outriggers used for taxiing. The aft portion of the vertical panels between the wings is a split rudder/air brake arrangement.

The question was asked about how Ligeti was killed in while flying the second version. Chris indicated he was told that at the time these flight were being conducted, Australia had a rule (circa 1987) that experimental aircraft could not fly above 500' *(this is has been changed since then)*. He had changed the airframe significantly as noted above and was hurrying the development of what would be the production model. He apparently was making a landing approach at a very slow speed and stalled the aircraft. He wasn't wearing a helmet and really hadn't put together a detailed flight test program as most engineers would do.

One of the things being considered by Chris as part of the project development would be to fly a test version as a UAV. There are now sufficient avionic packages that will allow for this type of a test program without risking life and limb, which he is not prone to do. It was noted that at 17' span the actual aircraft is

not much larger than many quarter scale R/C models these days, so the UAV plan looks very feasible.

Ron Ligeti, son of Charles, is continuing work on the design in Australia and is in the CAD drawing stages, but with no flying airframe as yet.

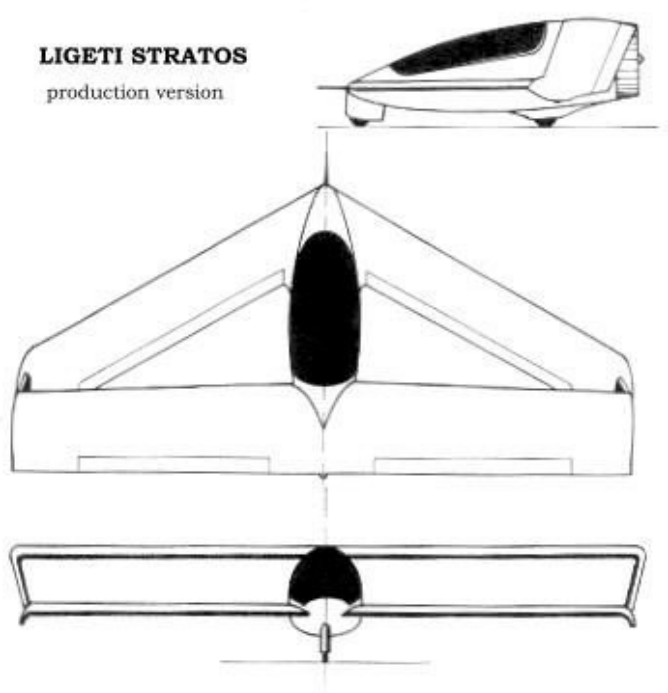
Chris' plans are to build a quarter scale model for some flight testing and then a full size mock up to go over things like ergonomics, control cable runs, engine mount dimensions, etc., before actually getting into building a flyable airframe.

The question was asked if Chris planned on staying with the ducted fan in his version. He had heard that the aircraft wouldn't get off the ground without this option, since it created enough increase in thrust over a conventional engine/propeller combination. Secondly, he feels that the duct provides additional safety for people around the aircraft, especially if the engine is running. He also feels it adds to the esthetic value of the design.

Chris showed a couple of pictures of test wing build by Ron Ligeti a couple of years ago. They were done more as a prototyping exercise since it was non-structural foam but with carbon spars. As can be seen from the photo below they don't use specialized molds or other more sophisticated construction techniques. This was partly an attempt to reverse engineer the original aircraft since there were no drawings or design specifications Ron could work with to produce and similar aircraft. However, he does have the original airframe that he supposed keeps in flying condition but has not flown.

Below is a picture of the typical fuselage construction by creating the bulkhead templates and forming the foam outer surface around them. They then fiberglass over the outer foam, break out the inner templates and then create a foam sandwich by glassing the inside.

The photo below is a 3-view of the second prototype is all Chris has that shows the differences in the two airframes. The most apparent items are the increased fuselage area leading into the ducted fan. This is somewhat difficult to see in the side view, but you can see the dorsal fin is gone, being replaced by a faired wheel in the fuselage structure. The outriggers have been streamlined and the upper wing is blended in a smoother manner to the vertical fins instead of a more blunt butt joint. The cockpit is also a little longer and wider to accommodate a larger pilot. The wing structure was also changed from a foam core to the hollow version with a carbon spar. This method wasn't favored due to concerns of harmonic vibration so wouldn't be used in a production version. You can also see there is no dihedral in this model. There are no flaps with the front wing having the ailerons and the upper wing having the elevator.



The engine thrust line was moved down from the original version, which along with the modified strake type system funneling are into the engine may have been a contributory factor in the accident.

At this point Chris went into the plans for this aircraft, specially what the open source design program means. In the software world this means users have the ability to identify and change things like bugs and work with others to improve the programs without the constraints of a major vendor like Microsoft.

This is the first time that Chris is aware of where an aircraft has been used as a subject of open source design. He has convinced Ron Ligeti to release his plans with the promise that a web site will be developed to promote the design project (which has been done at: http://www.ligetistratos.com/. The idea being that the public exposure will create additional interest for the time Ligeti actually has kits available. The fact that the patents on this design configuration also made it easier to convince Ron of the benefits of this approach.

The second part is to bring together a collaboration effort among a large number of interested parties. This will involve putting up bulletin board, mailing lists, parts vendor listings, etc., to enable potential builders to interact with each other to share ideas, photos, techniques, etc. This approach allows for quicker development by tasking groups within the project to take on specific things like doing an extensive search for the most appropriate engine, or parts houses that can provide materials and then sharing the results through the open source programs.

The question came up about designing by committee, which was one the original failing of TWITT when we took on design of a flying wing. Chris commented that they still are not sure how well this concept will work, but theorize that there will be an individual or core group come forward during the process that will lead the project in the desired directions and make the difficult decisions.

He acknowledged there is a lot of work to be done on making this concept work in the aircraft development arena. It has been done in the auto industry although there has been no cars come out of it yet. He also noted that eventually this will need some specific funding that will have to come from the participants or hopefully from some core sponsors, like Aircraft Spruce or the selected engine manufacturer. In turn they would get exposure through the open source programs, get business from the group by buying parts and materials, and having their logos pasted to the aircraft. He is very excited about the whole prospect of the open source program. We will have to stay in touch with him to see how it goes.

Below are the specification sheets for the original Stratos and the production model. I have also included a couple more of the CAD drawings of the original version so you can see some the features no evident in the photos in the article.

Ligeti Stratos

Price: U.S. $8000 for the kit.

Specifications:

Wingspan	17.5 ft.
Wing area	80.7 sq. ft.
Overall length	8.2 ft.
Overall height	3.3 ft.
Landing gear type	tandem mainwheels, wingtip wheels
Seats	1

Engine: Konig SC430, 28-hp, three-cylinder, two-stroke.

Weights and Loadings:

Gross weight	414 lb.
Empty weight	172 lb.
Useful load	242 lb.

Calculated Data:

Wing loading	5.13 lb./sq.ft.
Power loading	4.79 lb./hp
Payload, full fuel	207 lb.

Propeller: Three-blade nylon.

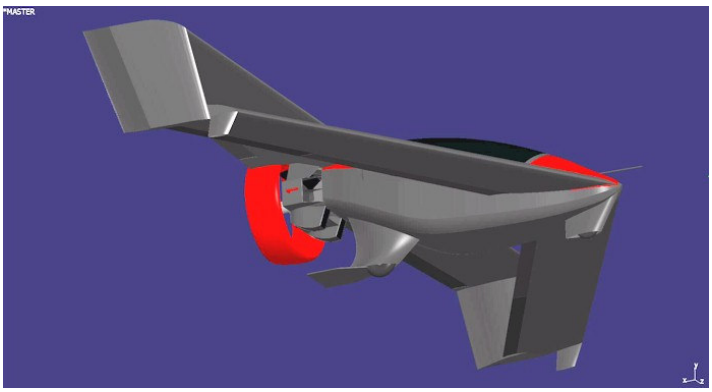
Performance:

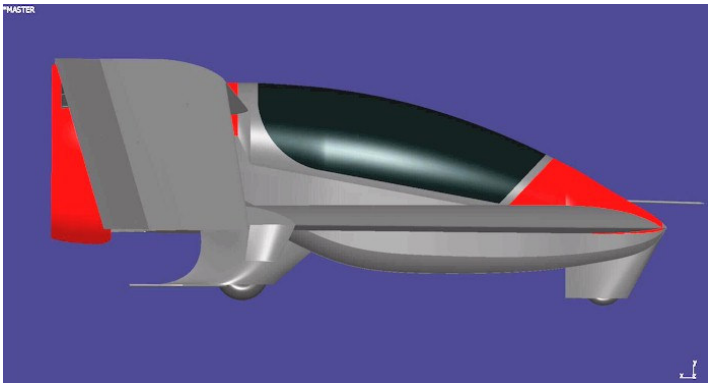
Maximum speed, sea level	124 mph
Cruise speed, 75% power	112 mph
Range, 75% power	449 mi.
Rate of climb, sea level	670 fpm
Service ceiling	14,760 ft.
Stall speed, clean	36 mph
Approach speed (1.3 x stall)	50 mph
Takeoff ground roll	360 ft.
Landing ground roll	278 ft.

Manufacturer:
Ligeti Aero-Nautical, Ltd.
P. O. Box 362
North Balwyn, Victoria
Australia 3104

Source of information: Ligeti Aero-Nautical

Other notes or comments: Stratos kits were not yet available in the United States at the time of publication.





LETTERS TO THE EDITOR

Andy:

My eyesight is fading, so writing is an effort now, but I did enjoy the Schriever Flying Peg Top article.

Some material you might be interested in is contained in a catalog by Adventures Unlimited of Kempton, IL. All about German secret technology and other exotic stuff. I think you'd enjoy including stuff about Tesla, etc.

The catalog itself is a fascinating read, even with a magnifying glass.

Best regards,

Edwin Sward
Worcester, MA

(ed. Ed sent this in some time ago and it sort of got lost in the shuffle of paperwork on my desk and in the TWITT pile.

For those of you without an Internet link, the catalog is free according to their web site and can be ordered at One Adventure Place, PO Box 74, Kempton, IL 60946.

For those with a connection the link is: http://www.adventuresunlimitedpress.com/catalog.php

Looks like it could be interesting based on the cover.)

Aircraft Specifications - Second Generation Production

Built in 1985-87

Engine (Prototype): One Konig 2-stroke 3 cyl. engine of 24hp at 4200 rpm driving a three bladed ducted fan

Dimensions:

Wing span:	5.36 m (17 ft 7 in)
Length:	2.48 m (8 ft 2 in)
Height:	0.99 m (3 ft 3 in)
Wing area:	7.53 m2 (81 sq ft)

Weights:

Empty:	78 kg (172 lbs)
Gross:	188 kg (414 lbs)

Performance:

Max. speed:	180 km/h (124 mph)
Max. cruising speed:	180 km/h (112 mph) (97 kts)
Max. (prototype) dive speed:	278 km/h (187 mph)
Stall speed:	56-61 km/h (36-38 mph)
Endurance:	5.25 hrs.
Service ceiling:	4500 m (14764 ft)
Design load factors:	+9/-6g load limits
Glide ratio:	35:1"

March 11, 2008

Dear Friends of the Wing:

Please do me a favor and stop sending me the newsletter in the future. The reason for this is my old age.

Over the many years that I received and read your newsletter I found it always extremely interesting and stimulating. You certainly did and do a very good job with this newsletter. Thank you very much for it.

Sincerely yours,

Karl Nickel

(ed. I am very sorry we are losing Karl as a subscriber. He has contributed much to TWITT over the years since he had so much first hand knowledge of the Horten brothers work. We will miss his input.)

March 16, 2008

Andy:

As always I enjoyed the meeting. Thanks to you and Doug for all the information you have given me. Also thanks for a great newsletter. As a past EAA chapter newsletter editor, I know the work involved.

See you next,

Steve Torpey
<torpey4@sbcglobal.net>

(ed. – Steve has come down all the way from Bakersfield for the last couple of meetings. He asks a lot of questions and offers a lot of insight, so it always a great exchange of information. Gavin and Steve had a good post presentation discussion with Chris Alan.)

March 24, 2008

Hello to All:

The Horten aircraft that stir me most, are the Ho X-a and Ho X-b foot launchable gliders. However, all the information found so far on the net does not refer to the availability of copies of the original plans. Does anyone know where such plans or even building instructions for the above would be available? (Not R/C model plans)

Kind regards,

Thomas Rupp
<tomrupp@mtnloaded.co.za>

(ed. – I responded with: "Thank you for the inquiry. As far as we know there are no plans for any of the Horten designs unless they were prepared during some type of restoration. There would be a lot of interest in such plans, especially for the foot-launched versions.

Sorry we couldn't provide you with better news.)

Hello Andy

Thank you so much for your reply. Sad, if all the plans from Cordoba etc. are lost. If there were at least information about mean dimensions, chord values for increments of span, profile and twist data.

The reason I am after this info is that I work (theoretically) for some years on the concept of a glider similar in planform and size to a Ho X-a, but with a foldable frame like a conventional hangglider.

On this path I came across some very ingenious concepts which were unfortunately not pursued to any commercial level. The reasons mostly being a lack of funds or interest rather than unpromising prototype results.

As examples I may state Yvon Peret's incredible 'Sock' and the 'Rubikon' by Peter Erb of the Akademische Fliegergruppe Darmstadt. Both projects happened about 15 years ago.

Kind regards,

Thomas Rupp

March 25, 2008

Collection of manned flying wings of the last 100 years

www.niegratschka.de/nuri or Google 100 Jahre Nurflügel

Klaus Niegratschka
<klaus@niegratschka.de>

(ed. – This site has a lot of pictures on a very long vertical page. Some of them are from other web sites, while others have come from places or websites I haven't found yet. The text is in German but he had included a design index. An interesting visit.)

From the Nurflugel Bulletin Board:

Hello All

Two questions.

1. Could someone please direct me to a mathematical treatise on the advantages of an unswept and a swept flying wing? Hopefully there will be a paper or someone would have done some analysis that will have been produced relatively recently so will be constrained by the performance of modern airfoils, (i.e. mh78 et al vs. 23015), that could show that the performance of the unswept is better at low wing loadings or that the swept flying wing is a better proposition above 0.7 mach or something totally different.

2. Could anyone point me to methodology for the design of an unswept flying wing, i.e. the comparisons with varying section-pitching moment along the span?

Any help would be very appreciated.

Mark Hills
<markhills@clara.co.uk>

Mark:

What follows is my opinion. And it is very BIASED. The simple answer to your question is that: the analysis you seek does not exist.

The forward swept wing has some proponents, Fauvel and Marske. Both have done excellent work, and Marske in particular has done a lot in perfecting that particular design option.

The unswept plank has also had a lot done with it. Backstrom used it very well. This type seems to have fallen out of favor recently. One test pilot I spoke with who flew Backstrom's plank mentioned the pitch damping was not possible to achieve.

The swept wing seems to have gotten the most attention, notably used by Lippisch, Northrop, and Horten. This style also gathers a number of supporters, but even they do not agree (elliptical vs. bell shaped span loads). Nickel has done a lot of analysis on the subject; his book is excellent (and John Anderson agrees). However I don't think either of them went far enough (and on this side are Prandtl and RT Jones). I have been convinced by the arguments of Prandtl, Jones, Horten and more recent researchers that bell shaped is correct (for unconstrained span, swept wings with minimum drag, correct flight dynamics, and minimum structure).

In both the swept cases (forward and aft) you do have the advantage of tail moment due to the sweep. Forward swept is analogous to a canard, aft swept is analogous to a conventional tail. And excessive sweep in either of these cases results in making low drag laminar flow impossible.

Natural solutions seem to point towards mild aft sweep. This is what pelagic birds (soaring sea birds) do. Most raptors (soaring land birds) tend towards the plank solution, though most of them carry substantial horizontal tails.

So I don't believe there is a definitive analytical answer to your question. So I go back to natural solutions as being optimal for a reason.

Al Bowers
<Albion.H.Bowers@nasa.gov>

Okay, planks can taper, right? Does the MAC have to be straight or would a long AR delta count as a plank?

Doug Holverson
<dholverson@cox.net>

Al Bowers / DGH:

Well done Al and my opinion is very BIASED also. I pretty well agree with what you said and I would like to add to your remark about Plank pitch stability. I too found the long Phugoid Cycle to be divergent in my XM-1D 'Plank' and Monarch 'E'. I would notice that if I held the stick firm the pitch cycling instability would dampen out completely. Only with the stick free would the pitch instability occur. Every time the nose came up and the speed bled off to almost stall speed, the stick moved forward on its own and dumped the nose.

As the speed built up the stick would creep back and the nose rise, followed by a speed bled off and the stick again abruptly moving forward dropping the nose. Each 30-second cycle would see a slight increase in divergence. So, to solve the problem I (100%) mass balanced the elevator, which greatly improved positive dampening in the stick free flight mode.

Al Backstrom built a Super Plank which had an 8-H-12 helicopter airfoil. The reflex portion of the aft airfoil

was built into the Elevons as well which acted like a giant trim tab giving a strong nose down pitch trim. Constant backpressure was required to hold level flight. Adding several springs did not help. What was needed was to construct Elevons with a symmetrical cross section and a small trim tab added at the trailing edge and bent down about 10 degrees. The 10-meter Super Plank held a lot of promise for a small, low cost sailplane but I believed it was scrapped.

A last remark for DGH is what do you call a taper wing Plank? I call mine a 'Reverse Delta Plank.'

Jim Marske
<jim@marskeaircraft.com>

My Nimbus 2C has a wildly divergent phugoid, which will exceed redline after 2 or 3 cycles with the stick free. Open the dive brakes and it is instantly damped.

As I understand it, the phugoid is too slow (~18 seconds per cycle) for the overall geometry of the glider to have any effect. The real source of damping is simple drag. High drag, low performance gliders have damped phugoids and low drag, high performance don't - at least until you open the spoilers.

Of course, there is usually another pitch resonance around .5 - 2 Hz. This is fast enough that it does depend on tail area for damping. I found Jims XM-1 to be fairly sensitive to pilot induced pitch oscillations in this frequency range although it would damp out if the pilot stopped moving the elevator. The Pioneer 1A would resonate with stick inputs at about .5 Hz but damp almost instantly when you stopped pumping the stick.

To be fair, most conventional tailed gliders will do about the same thing. The Grob 103 is notorious for a PIO resonance that matches the nose-to-main wheel and back bounce frequency (Pilot Induced Bounce - PIB). A lot of G103's have ended up as a pile of broken fiberglass because of this.

Bill Daniels
<bildan@comcast.net>

Al-

Am I missing something here? It seems to me that the forward-swept wing with elevator in the central (furthest aft) trailing edge would be analogous to the conventional configuration. The tips, being forward do not need much, if any wash out, because of span wise flow tendencies toward the root and don't seem to stall first, according to what I've read. The limitations placed on AOA by root stall should pretty much ensure that. I can't think why anyone would put elevators near forward swept tips, and elevons seem unnecessary. I suppose Jim or Bill could speak to this. Just a thought from the bleachers.

Serge Krauss
<skrauss@ameritech.net>

Serge,

Thanks for that catch, of course you're correct. I was thinking of the case of elevons at the tips.

Jim & Bill point up related problems, and solutions. Mass balance can assist in one situation (Jim & the Monarch) and hurt in others (Bill with the early Nimbus IIAs & Janus IIAs). Mass balance also only gives one pitch feel based on G, and you'd really like to have the feel per G increase with airspeed.

Jim also, correctly brings up another solution, that of using a tab on the elevon. This can work very well, but can also work badly. Akaflieg Braunschweig had a problem on a tab with the SB-13 sailplane. The tab caused a dramatic reduction and eventual reversal in stick force in pitch at high speeds.

Ilan Kroo (who is testifying before Congress tomorrow) has another brilliant solution where sufficient sweep allows flaps to trim the aircraft (SWIFT). Guenther Rochelt did something similar where the flaps created neutral trim changes (Flair 30).

And Serge, you were never an observer in the bleachers. You're always one of the leaders out there, along with many of the other greats on here. Keep at it guys. We have a long way to go before we solve all the problems!

Al

Wow-

Guess I wrote before waking up. I was, of course, referring to the blanketing turbulent flow near stall that prevents the centrally placed elevator from actually stalling the wing on the JM designs, limiting the wing's AOA. It would be a sad thing for the aft to fully stall on the fwd-swept designs.

SK

Hello to All.

I want to share with you my indoor flying wing. After years of reading the papers from Al Bowers on Nurflugel.com , many thanks Al, and getting inspired by others like Diego Roldan and his fine job on the Horten 1b I too have my small contribution, just a model.

At first the wing was tried with a trike but was too heavy, without it and with a lighter motor and batteries it came to 106g and flies very well:

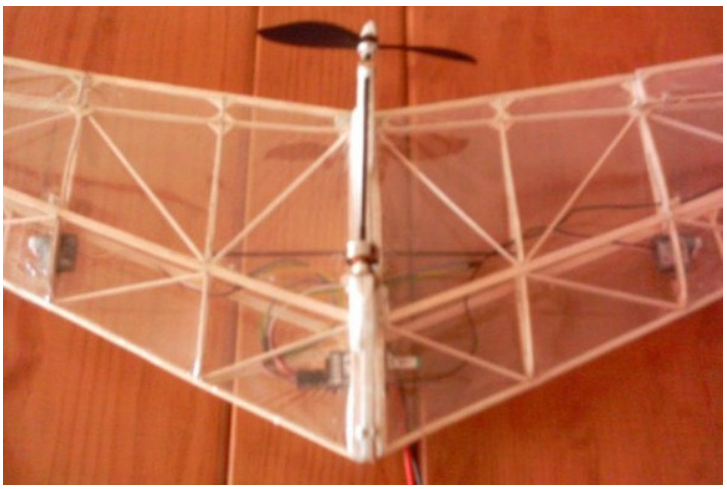
http://www.youtube.com/watch?v=boCL99MrQwc
http://www.youtube.com/watch?v=S1SY7iCpCyo

Photos: http://fotos.sapo.pt/chispas/playview/4

Still have too much to learn about these marvelous airplanes. My next flying wing will be something like a Dune D8.

Have good flights, if not real at least in dreams.

Paulo Faustino
Portugal
<pchispas@gmail.com>



This is frame from the video showing it flying in a large gym-like facility.

From the Mitchell U-2 Bulletin Board:

I was wondering if anyone had an opinion on the reason behind DM using the inverted airfoil on the elevons for the U2. I have read all the NASA reports I could find, and I couldn't see where anyone else used that setup.

Mike Thompson
<MikeT52@roadrunner.com>

As far as I can tell he never explained his reasoning but it may have been something like this:

"The main+auxiliary airfoils form a slotted reflexed profile. In a solid reflexed section the reflexed part is lifting down so it makes sense to have the camber of the stabilator pointing down. Also with the stabilator upside down its pitching moment is working for us"

Years ago I wrote an article about external airfoil flaps for TWITT. You can download it here: <http://users.acsol.net/~nmasters/temp/Sept03Ltr.doc> The source material is listed here: <http://users.acsol.net/~nmasters/External_airfoil_flaps.htm>

The links to the NACA reports are broken since they moved to a new domain but the abstracts are there and a bunch of non NACA references.

Norm Masters
<libratiger62@yahoo.com>

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.

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

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VHS tape of Al Bowers' September 19, 1998 presentation on "The Horten H X Series: Ultra Light Flying Wing Sailplanes." The package includes Al's 20 pages of slides so you won't have to squint at the TV screen trying to read what he is explaining. This was an excellent presentation covering Horten history and an analysis of bell and elliptical lift distributions.
Cost: $10.00 postage paid
Add: $ 2.00 for foreign postage

VHS tape of July 15, 2000 presentation by Stefanie Brochocki on the design history of the BKB-1 (Brochocki,Kasper,Bodek) as related by her father Stefan. The second part of this program was conducted by Henry Jex on the design and flights of the radio controlled Quetzalcoatlus northropi (pterodactyl) used in the Smithsonian IMAX film. This was an Aerovironment project led by Dr. Paul MacCready.
Cost: $8.00 postage paid
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An Overview of Composite Design Properties, by Alex Kozloff, as presented at the TWITT Meeting 3/19/94. Includes pamphlet of charts and graphs on composite characteristics, and audio cassette tape of Alex's presentation explaining the material.
Cost: $5.00 postage paid
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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".
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