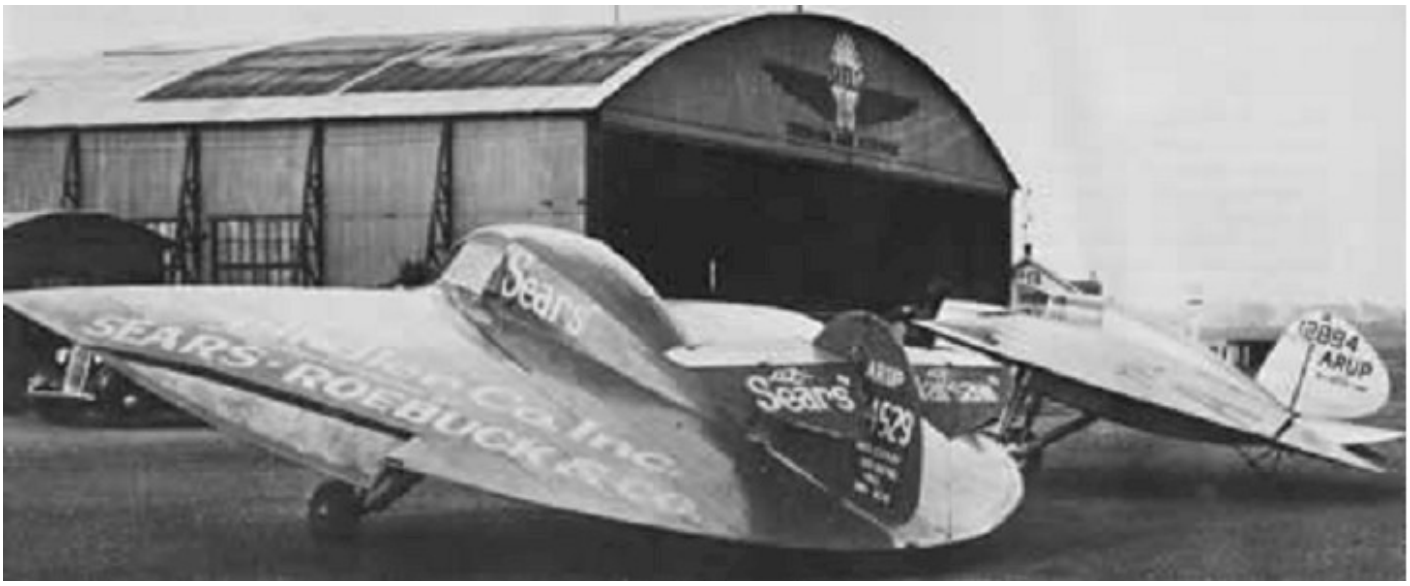
No. 321 MARCH 2013

T.W.I.T.T. NEWSLETTER



Arup S-4 (foreground) demonstrates the practicality of a low aspect ratio wing. Both Arup S-2 (background) and the S-4 were frequently used as flying billboards during their accident-free careers.
Source: http://www.century-of-flight.net/Aviation history/flying wings/early US flying wings.htm

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

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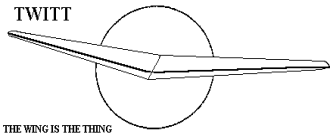

THE WING IS THE THING (T.W.I.T.T.)

T.W.I.T.T. is a non-profit organization whose membership seeks to promote the research and development of flying wings and other tailless aircraft by providing a forum for the exchange of ideas and experiences on an international basis.

T.W.I.T.T. Officers:

President: Andy Kecskes (619) 980-9831
Treasurer:
Editor: Andy Kecskes
Archivist: Gavin Slater

The **T.W.I.T.T.** office is located at:
Hanger A-4, Gillespie Field, El Cajon, California.
Mailing address: P.O. Box 20430
El Cajon, CA 92021

(619) 589-1898 (Evenings – Pacific Time)
E-Mail: twitt@pobox.com
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Wt/#Issues	FRG	AUSTRALIA	AFRICA
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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

Another month just sort of rushed up on me with the first falling on a Friday and putting me behind with publishing this issue. So I have decided I am not going to worry about maintaining a strict time line for getting each issue in the mail. They will go out somewhere around the 10th to 12th of the month or perhaps earlier if I have enough material to quickly put something together.

We have a good mixture this month as you can see from the table of contents above. Hopefully some it will generate questions or comments that will spark a discussion of theories or other such stuff to peak everyone's interest.

I am hoping that with the spring and summer rapidly approaching that some of you will be getting your favorite flying wing back into the air without snow on the ground. Please take some digital pictures of your pride and joy and flying site and pass them along.

With the improving weather I am also now getting back to work on my 1-26 project. Fabric is now on the left side of the fuselage and by the end of next week I think I will have almost all the fabric on the fuselage. The only holdup might be getting the aft section inspected before closing it up with the turtle deck piece. Then the long job of spraying Poly brush and silver will start.

Andy

LETTERS TO THE EDITOR

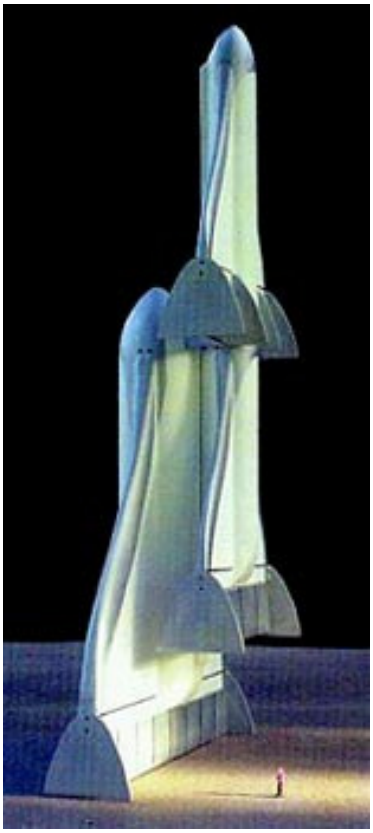
Hello Andy,

Here are links (here and also below) to information on Advent Launch Services (see: www.adventlaunchservices.com), a private spacecraft company that is developing a family of delta-winged, water-launched & water-landing reusable spacecraft--orbital as well as suborbital. I am helping them. The vehicles are all of a common, scale-able design. They all use pressure-fed LOX/liquid methane rocket engines that have unique "2-D" rectangular exhaust nozzles. Movable flaps (like those used with the similar "2-D" nozzles of modern jet fighters) provide both thrust vector control and altitude compensation (like that of an aerospike rocket engine); in space, attitude control is maintained by cold-gas thrusters using residual gaseous methane from the fuel tank. Also:

Their smallest, suborbital space tourism vehicle (I've provided its specifications below--they are from here: www.secretprojects.co.uk/forum/index.php?topic=11041.0) is 35' long. Their orbital vehicle uses three stages, each one of which is an up-scaled version of the suborbital craft and uses multiple LOX/liquid methane rocket engines. Below (above the specifications for the suborbital vehicle) are more links to information on Advent Launch Services' designs (see: www.google.com/#sclient=psy-ab&hl=en&tbo=d&site=&source=hp&q=Advent+Launch+Services&oq=Advent+Launch+Services&gs_l=hp.12...0.0.1.24155.0.0.0.0.0.0.0..0.0.les%3B..0.0...1c.dkg5FhbT07U&bav=on.2,or.r_gc.r_pw.&bvm=bv.1357700187,d.cGE&fp=27a6744d958f4d5d&biw=792&bih=377). Here are the suborbital craft's specifications:

Vehicle Specifications

* Name: Advent
* Length: 35 feet
* Diameter: 4.75 feet (12 ft wingspan)
* GTOW: 12,600 lbm
* Dry Weight: 4,100 lbm
* Crew Capsule: 8 feet long, 4.5 feet in diameter
* Crew Environment: Cabin pressurized to 1 atm with no pressure suits
* Payload Capacity: 600 lbm
* No. of Engines: 1
* Propulsion System: Pressure fed
* Fuel: Liquid Methane
* Oxidizer: Liquid Oxygen
* Total Thrust: 18,900 lbf
* Reaction Control System: Cold gas methane



Mission Specifications

* Alt. at Ignition: From within the ocean
* Orientation at Ignition: Vertical
* Max. Accel. Force on Ascent: 4.6 g
* Alt. at Engine Cut-off: 145,000 feet
* Time at Engine Cut-off: 97 seconds
* Max. Speed: 3,600 feet/second
* Max. Altitude: 105 kilometers
* Time in Weightless Conditions: 220 seconds
* Reentry Method: Aerodynamic controlled glide
* Accel. Forces on Descent: 5.2 g
* Landing Method: Winged rocket designed to glide down to ocean surface for a safe, controlled, horizontal landing
* Total Duration: 13 minutes
* Landing Distance from Takeoff Location: 0 kilometers
* Time Between Missions: approx. 4 hours

(ed. – The following was another message from Jason that included Jim Akkerman from Advent. There was some duplication that I have edited out.)

Hello Jim Akkerman and Andy Kecskes,

Since both of your organizations have some interests in common, I thought that arranging a mutual introduction might be helpful to both of you. Advent Launch Services (see: www.adventlaunchservices.com) is developing a series of winged spacecraft that are tailless (delta-winged) and launch from (and land on) the sea and/or lakes. T.W.I.T.T. ("*T*he *W*ing *I*s *T*he *T*hing," see: www.twitt.org), of which I am a member, is an organization that promotes research and development of flying wings and other tailless aircraft. Now:

In addition to its uses for suborbital tourism and (in the multi-stage configuration) as a fully-reusable orbital launch vehicle, I think the Advent vehicles could also serve as point-to-point suborbital "boost-glide" trans-continental and trans-oceanic winged rocket ships, in the manner envisioned by Dr. Wernher von Braun, Dr. Hideo Itokawa, G. Harry Stine, and Dr. Hsue-Shen Tsien. Their ability to operate from water would enable any seaport (or lakeport, as on the Great Lakes) cities to serve as spaceports, *without* having to construct any supporting infrastructure to facilitate operations of these space planes. Since their rocket engines burn LOX (liquid oxygen) and methane, local supplies of their propellant either already exist or could easily be arranged for. Also:

Advent Launch Services could use some help to complete the development of their vehicles, and T.W.I.T.T. has many members who have technical expertise and contacts; perhaps some "networking" could bear fruit. Also (from T.W.I.T.T.'s point of view), the Advent space plane design is a unique application of the tailless concept; in addition to being tailless, the smaller craft do not even possess vertical stabilizers, relying instead on long, tapered strakes on the delta wings to provide yaw stability. Each strake houses a rocket engine at its rear.

Jason Wentworth

(ed. – This looks like a very interesting project so if you want to get involved visit the website and follow the contacts link.)

Bob (Hoey),

I just got all the info on the Turkey vulture and the plans.

Have you ever attempted a build using dollar tree foam instead of balsa.

Thanks,

Ron Praver
<rpraver@gate.net>

Hi Ron.

No I have not tried to use foam in the building of a bird model. I have recently begun working with EPP and Depron for other kinds of airplanes and see no reason why it wouldn't work for a bird model.

The wing airfoil might be a bit tricky since usually there is an airfoil thickness or camber change between the root and tip which might be tough to hot-wire. Carbon tubes and rods for spars should allow a weight similar to balsa.

I know of some builders who have used the fuselage structure as a mold and produced a fiberglass shell for the body. Don't know how the weight compares.

One of the important features of any bird model is to keep the outer wing panels as light as possible to keep the roll inertia low. Foam should work for that.

If you try it, let me know how it works.

Bob Hoey
<bobh@antelecom.net>

(ed. – If anyone out there has any experience with building bird model wings (besides Bob) perhaps you could drop both of them an e-mail on what you have learned about the problems Bob has pointed out. If you do reply, please copy TWITT so we can share.)

Andy,

I am finding the website very useful. I am currently refining a mathematical method of approximating the neutral point for a swept and tapered wing which is more accurate than the quarter chord point of the mean aerodynamic chord currently used (K. Nickel termed this the C-Point). Would you be interested in an article on this for your newsletter?

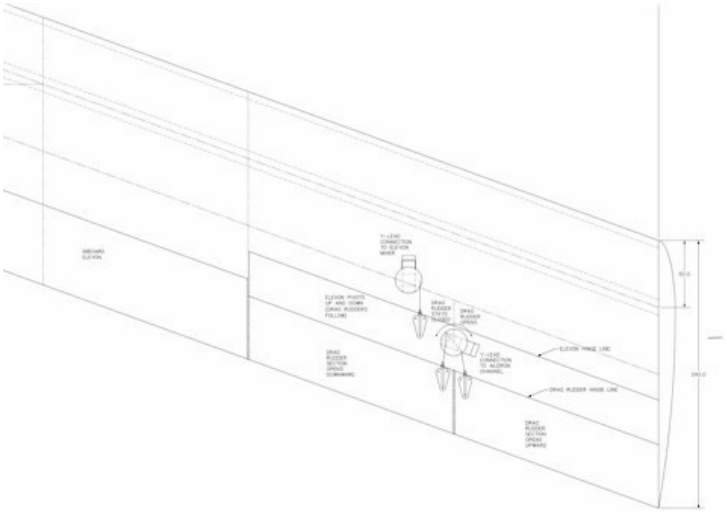
Best regards,

John Newton (UK)

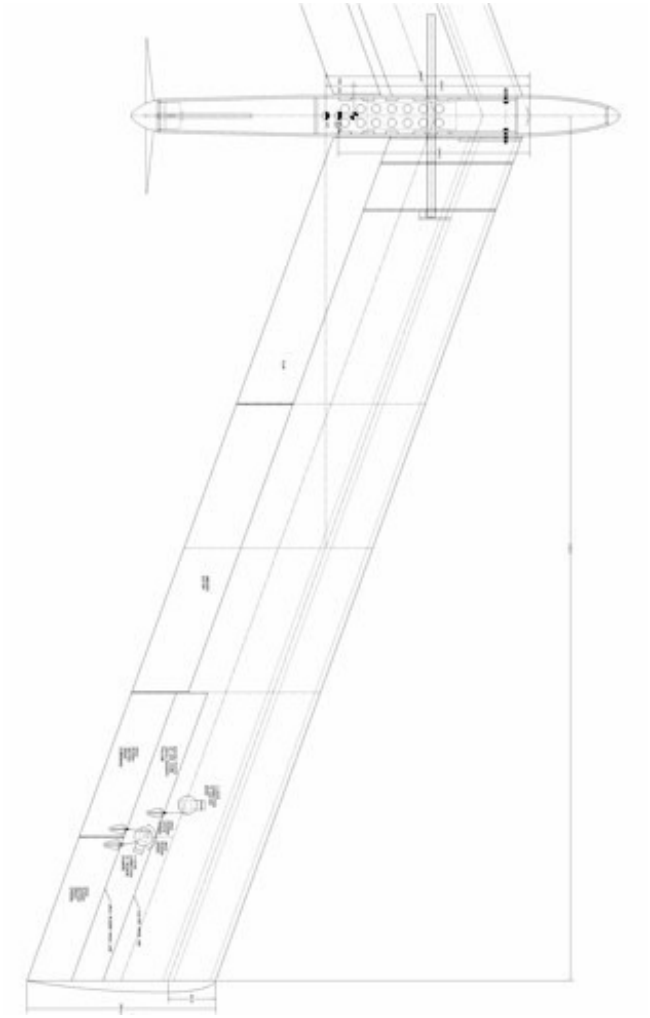
To Bill and Bunny Kuhlman and TWITT members,

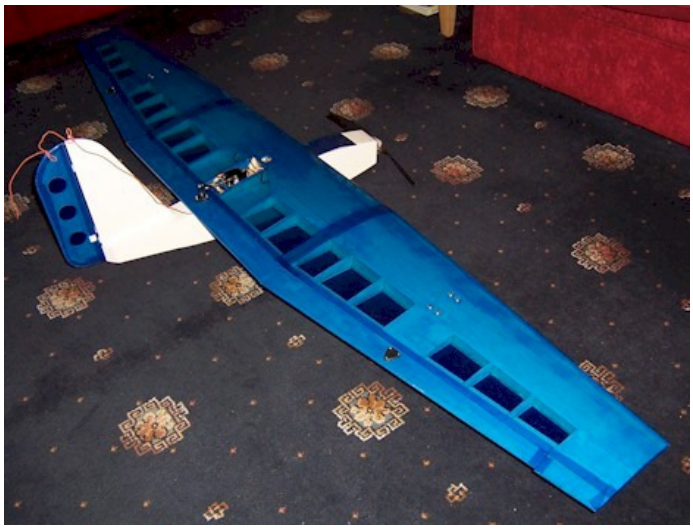
I read with interest your intention to use Kasper flaps to help avoid adverse yaw on Ken Bates' Windlord. I only recently discovered the Kasper flap and it looks like an intriguing solution. Looking at the design I wonder if the connecting linkage between the flap and the main control surface could be moved inboard more centrally relative to the flap to prevent the flap twisting under load. You would not normally want to have a linkage at the extreme end of a control surface, makes me wonder if this contributed to the flap coming adrift on the full size Kasperwing?

Before I became aware of the Kasper flap I had been trying to come up with something that would increase drag on the inboard wing when the model was rolled to produce a coordinated turn and remove the adverse yaw. Attached is what I came up with. The drag rudder sections are connected to the main outboard elevon and move up and down with it, they are linked to the aileron control in such a way that they deploy on the inboard side of the turn when the model is rolled to increase drag, they could also be mixed in with the rudder channel to use as a conventional rudder control.



On the model wing I am currently flying which has two elevons per side (inboard and outboard) they are mixed to open in opposite directions on the inboard side of the turn when the rudder stick is used, as per Jurgen Haas suggested, this worked well in practice and I found I could counter the adverse yaw the model suffers by applying rudder along with aileron to get a coordinated turn.





I have been thinking some more regarding the Windlord based model you mentioned and I think it may not suffer from any noticeable adverse yaw if you retain the fin. I designed a model with a similar layout called the Soaring Fish-E (see attached photo), this featured a central elevator and outboard ailerons, turns were fine using aileron control alone without any

rudder application being needed, and I did not notice any adverse yaw. A word of caution, my model would tip stall if turning tightly at slow speeds using aileron alone, due I suspect to a combination of high taper, outboard ailerons with no differential (as required) and no washout.

Good luck with the model, I like the look of it.

I hope the above is of interest.

John Newton
jhndesign@hotmail.com
www.myskies.co.uk

(ed. – I realize the drawing images are a little light but they are as dark as I could get them from those sent by John. Hopefully you will get the idea of how he has arranged things.)

John,

Thanks for all of the information you provided.

Regarding the Windlord (below), we have the aileron cutouts constructed and have all of the aileron ribs manufactured. After looking at what's already been done, incorporating the Kasper flap is going to be complicated as the aileron cutout has too large a chord for a standard aileron.

Rather than reconstructing the outer wing panels, we've decided to go ahead and use the Frise ailerons originally envisioned. Having said that, I think a simple modification is in order - building the full Frise leading edge over only the last 40% of the aileron span. With mylar gap seals that will also help with static balance of the ailerons. We'll draw something up and put it into RCSD along with some photos of the actual construction process.

Regarding the Fish-E... We were in communication with Dave Jones, designer of the Ravne MB, Blackbird, and other "plank" plan forms some years ago and he mentioned that you should never use washout with reflexed sections as it destabilizes the wing. Our quarter scale Pioneer IID was rebuilt by the individual who bought it from us and a subsequent owner found that it tip stalled on winch launches. Turbulators over the outer part of the wing only slightly inhibited this tendency. After careful examination it was found washin had been inadvertently added during the rebuild. Once the washin was removed there were no more problems. The taper ratio on the Pioneer IID wing is 3:1.

The aileron/elevon system you describe is rather ingenious. Thanks for sharing it with us! If you photos are suitable for publication we'd be happy to include the information in a future issue of RCSD.

Bill & Bunny Kuhlman
RC Soaring Digest
http://www.rcsoaringdigest.com

THE WING LIFT WARS

Tony Burton

Bernoulli, Newton, or Magic?

(ed. - I received the following e-mail from Tony Burton: " This tale I had in an issue of Free Flight last year. It evolved from an e-mail thread at my club, Cu Nim Gliding of Calgary, Alberta. I thought that it would make good filler for Sailplane Builder (but I also thought for TWITT since a rebuttal next month will include some flying wing stuff). You are free to edit it as you wish, but credit Free Flight magazine." I hope everyone enjoys it.)

STEVE HOGG started it when he e-mailed to the Cu Nim Gliding Club newsgroup: "here is an enlightening video that shows the airflow over the wing, and debunks some commonly held beliefs. <http://www.physorg.com/news/2012-01-wings.html >"

Erin Doerffer, one of our very keen students, got things rolling with: "Oh God, I read it, and was instantly transported back to third year fluid dynamics: the Navier-Stokes and Runge-Kutta equations – *aargh*! It's more complicated than you think (even if you *are* an engineer or a physicist) and personally, I am satisfied with proof by – 'it works'.

When *Al Hoar* suggested a Wikipedia look-up (key word, *Lift* – then click "lift force"), *Brendan Mogan* did that and responded: In part this states, "What actually causes lift is introducing a shape into the airflow, which curves the streamlines and introduces pressure changes – lower pressure on the upper surface and higher pressure on the lower surface. This is why a flat surface like a sail is able to cause lift – here the distance on each side is the same but it is slightly curved when it is rigged and so it acts as an aerofoil. In other words, it's the curvature that creates lift, not the distance." But perhaps it is explained better elsewhere in his writings …

Tony Burton: "…it's the curvature that creates lift? Error in Wikipedia! – what about those little 8" sheet balsa gliders in cellophane wrap that you could push together and fly? It's clear and simple – Newton had the answer – for a wing to stay up it has to deflect the air down. Read all about it in *"Bernoulli … Bah!"* in the 1987/2 issue of *Free Flight*. Download it from the magazine archive on the SAC web page."

Dave Morgan: If you assume equal air transit times above and below the wing (not a good assumption), and calculate the change in air velocity, you will find that there is precious little lift generated due to the change in air pressure, which is very low. Unfortunately, most simplified text books attribute lift to Bernoulli's theorem which is wrong. The Bernoulli's were a family of brilliant mathematicians: 3 Johanns, 2 Nicolaus', 2 Jacobs, and a Daniel (of fluid mechanics). Poor Daniel's theorem is frequently misapplied.

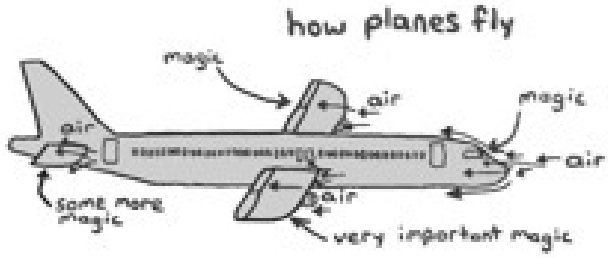
There is a reason we are taught fluid mechanics in engineering – it has so many applications in the real world. Unfortunately there is just no simple, easy answer as to why a wing can generate lift – you have to have at least a basic understanding of fluid dynamics – some knowledge of calculus helps as well.

Ted Sorensen: Too mechanistic; I prefer my theories to be more anthropomorphic. I direct your attention to the following paper at *http://www.messybeast.com/dragonqueen/liftdemon.htm:*

LIFT DEMONS AND THRUST PIXIES
Title of Paper: The Role of Lift Demons and Thrust Pixies in Heavier-than-Air Flight
Publication Date: 2004
Abstract: The role of Lift Demons in aeronautics was first explained in 1994 by Mary Shafer (NASA). Since then, Shafer's work has been explored and revised. This paper summarizes advances in Lift Demon technology over the last decade.
Keywords: Lift Demons, Thrust Pixies, lemon fondant
Authors: Sarah Hartwell, DEF Smith, Peter Rieden, Gavin Bull

Question: How did the secret information on Lift Demons make it into the public domain? I've been a practicing Aircraft Performance Engineer for the past twenty-six years and have always tried to explain how aeroplanes fly by using the official public explanations regarding Bernoulli, airfoils and other such rot.

Civilians just weren't ready for the truth. In fact, we generally don't speak about the magic directly. Most of our plans and estimates usually end with the phrase, "and then a miracle happens".



Answer: The science of Lift Demons was declassified in 1994, throwing this topic wide open for discussion and research.

According to Shafer:
"Lift is caused by Lift Demons. These little, invisible demons hold on to the leading and trailing edges of the aircraft and lift it into the air by flapping their wings (so, in a reductionist sense, lift is actually caused by feathers). Some of the demons are a little confused and they hold on backwards, causing drag. The reason that planes stall at high alpha is that the leading edge demons get scared and let go when they can't see the ground anymore. Lift demons have good taste and don't like to look at ugly aircraft, so they hold on backwards on ugly planes. That's why gliders have so much lift and so little drag and why F-4s have lots of drag."

Gerald Ince: I too have enjoyed this debate, but have to admit that most of it has gone over my head. For full disclosure, I do not have an engineering degree (although I do own a "scientific" calculator) and I have never met anyone from the Bernoulli family.

It bemuses me that we have enjoyed over a hundred years of powered flight, without being able to agree on

how it works. Given that the people working on this issue have, in the interim, managed to provide aerodynamic proof that bumblebees cannot possibly fly, it might be some time before this is finally resolved. Thank God the Wright brothers were bicycle mechanics rather than engineers, because we might still be standing on the ground looking upwards at the birds saying, “now that can’t possibly work!”

I don’t demand that my wings explain themselves – I am simply thankful that they “know how to do their job”. Not willing to take things for granted, I also take a more spiritual approach (just in case) and give thanks after each flight. At the end of each day, I give my wings a cool bath and then anoint them with sweet smelling creams and polishes, rubbing them vigorously with the hide of a dead animal (chamois) to maintain and enhance their magical properties. This has worked for me for over twenty years, and I suggest that students give it a try on the club ships.

And, keeping up with the latest developments, we are considering winglets for the Duo Discus as I understand that by bending the last foot or two of the wing up at a 90-degree angle, you can prevent the magic stuff from “draining out” of your wings! See – this stuff isn’t that hard!

Shulamit Kuttner: Oh, this is too funny! “… and then a miracle happens” isn’t so far from my fluid dynamics professor’s favorite phrase: “And it should be obvious that…” Great midwinter food-for-thought until the gliding season starts.

Erin: “It is left as an exercise to the reader…” As a calculus prof my dad would say, “it can be shown ‘a priori’ that...” Oh, engineering humor: “lift demons have good taste and don’t like to look at ugly planes”. LOL

The Flying Plank Group Thread

The Wings of Wasserkuppe: A Brief history of Rhön Mountains Motorless Flight
by Glen Griffitts

http://glider-pilot.co.uk/Wings%20of%20%20Wasserkuppe/Wings%20of%20%20Wasserkuppe.htm

This article must have had something misprinted wrong because it said the Ente was tailless then had this photo. What am I misunderstanding here?

Tommy Thompson

Lippisch's "Ente" was a canard, not a flying wing. As far as I know all of his flying wings were swept although the high aspect ratio "Storch's" had fairly low sweep angles. At the risk of going off topic I offer this video of the 1933 Rhoen competition: http://youtu.be/5Nk50u8MXT8 The last 1.5 minutes show a Lippisch design. There is a still image of this plane and a 2 view drawing here: http://www.j2mcl-planeurs.net/dbj2mcl/planeurs-machines/planeur-fiche_0int.php?code=3433
This is probably the last of Lippisch's high AR tailless gliders. Those of you who are members of the Nurflugel mailling list can read a short discussion of this plane at this URL:
http://groups.yahoo.com/group/nurflugel/message/13261

Associating that picture and text was a mistake. The glider you show is the "E2". The short fellow in the foreground is Lippisch and the tall swarthy gentleman behind him is his assistant on that project, Gottlob Espenlaub. "Ente" is the German word for "duck" which of course is also what "canard" means. A google image search turns up a lot of pictures of both gliders and the rocket powered Ente:

https://www.google.com/search?q=lippisch+ente&oe=utf-8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a&um=1&ie=UTF-8&hl=en&tbm=isch&source=og&sa=N&tab=wi&ei=QKIjUcP5IcOayQHNr4HwBQ&biw=998&bih=561&sei=46IjUc58qrvKAbjegbAE#imgrc=

Norman Masters

Thanks for setting the record straight Norman. So the Ente was a Plank planform with a canard :)
The link with all the photos were nice too.

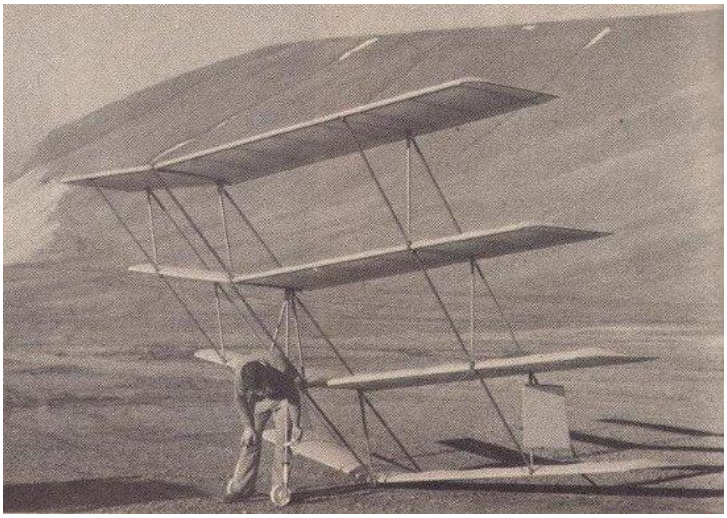
Tommy

(ed. – Check out the links included in these messages. There are some great pictures with the very long link for Norm being an album of Lippisch's exploits over the years.)

Nurflugel Bulletin Board Threads

Q: What do you get if two Icarus II biplanes get together…

A:
https://www.youtube.com/watch?v=Ao-ymagLypI



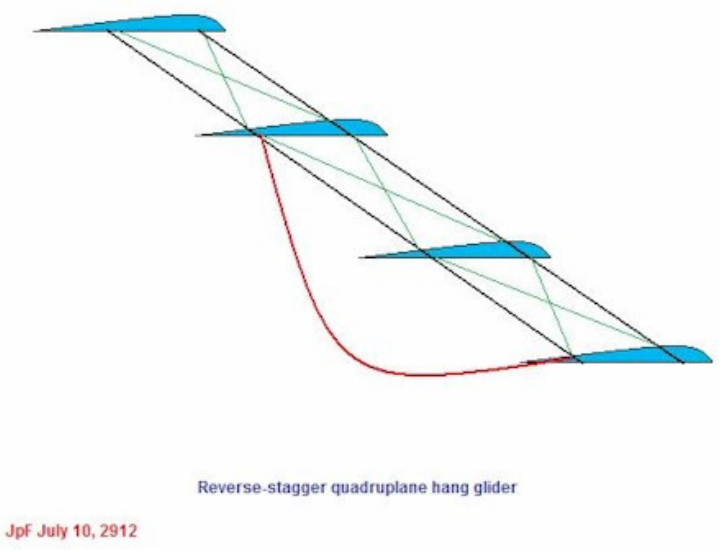
Al Bowers

PS. I am slightly amazed that such devices can be stable, controllable, and fly so well. Pretty cool…

(ed. – It was hard to find a picture since most of the links go to YouTube videos. The B&W image was all I could really find but that page also had the illustration. However, I am confused since the picture shows a forward stagger of the wings where the illustration is of a reverse stagger. Obviously from the video the forward stagger did work successfully. Maybe someone can explain it to me.)

Thanks, Al, for the link. I'd never seen Larry's quadruplane in action, although it has fascinated me. His predecessor and, I think, inspiration was Matthew Sellers, who built a quite successful, initially tailless, light-weight glider and powered quadruplane back around 1910, achieving some notoriety.

OK, the rest of this is just a big "FWIW", because I like multiplanes,...I guess.



Anyway, reading articles by Illan Kroo and the Stanford group several years ago, I was intrigued by how much induced drag can be diminished with multiplanes, even at attainable gap/span ratios. They quoted efficiencies of 136% for biplanes and 141% for "box-planes," compared to "equivalent" monoplanes (same area and span) with elliptical lift distributions. Unfortunately further compromises are also serious.

It's pretty easy from something like Di = kL^2 (induced drag is proportional to lift squared for a single wing) to show that the ideal induced drag of an n-winged multiplane is 1/n times the induced drag of an the equivalent monoplane. So the prospect of reducing drag by some reasonable part of 75% for a quadruplane would be attractive, even when diminished so much by mutual interference (Prandtl and successors). Of course for a quapruplane like Larry's, with his structure and goal, parasite drag looms large.

I never looked deeply into quadruplanes, but I did explore the biplane case some. Having no CFD, I went to my trusty Walter Diehl (NACA aerodynamicist and author) text of 1928-1936. Diehl was a very lucid and conscientious writer on aero theory who dealt with multiplanes when they were still common. So he introduced factors and graphs for wing forms and proximities, as well as the basic mathematics of

aspect ratio's affect on induced drag. A couple NACA reports (see #586) also showed Reynolds Number affects on CDi and Cl. So I started at the ideal 200% figure and adjusted downward for everything that compromised that ideal. I actually came out within a percent of the Stanford figure.

The real problem though is aspect ratio and Reynolds Numbers, because you have to start with a reasonable monoplane wing for your comparison. If a monoplane has a very normal aspect ratio of six, then you are already at 12 for the biplane of the same area. For models - and hang gliders - that reduces the chord and thus RN near critical values. I carried this further for a biplane CL model stunter and came out with a figure of just about 100%, which I think can be improved upon at larger sizes and with better use of composites. So that was better than anyone on that forum expected.

I have tried to explain potential multiplane advantages to the CL stunt model builders and fliers, who don't have to contend so much with parasite drag, but most of them "don't need no steenking math." So obviously for them, no thinking is necessary. They already know that the Earth is flat and that more wings mean more induced drag. For some of us adventurers though, especially with decolage and high-lift, minus appendages...

Ah, FWIW.

Serge Krauss

Al, I see a glider with a very deeply placed CG. Would it fly as stable if the pilot was really higher? Ok, ground clearance would become the new problem. But I like the idea of having a rigid wing that can be constructed with about six parts. If the assembly can be done with quick releases it might take less time to mount that the setup time of a regular hang glider.

Just my quick first reaction.

Keep that brain spawning wings,

Koen Van de Kerckhove

Very interesting to see such a glider fly. It feels that the roll controls are sufficient and the pilot has good maneuverability. I would like to know how much testing did Larry Hall made. Did it fly thermals? It probably could circle very tight, giving such a design a advantage by allowing to fly inside thermal cores.

In principle there would not be a problem with stability in normal conditions but with very low CG´s hang-gliders are more prone to tumbling. The center of rotation is the combined CG from the glider and the pilot and lies somewhere in between both. The lower this point is from the wing the easier it is to tumble. Note that paragliders do not suffer from this because they collapse before. Interesting that good acrobatic paragliding pilots manage to perfect tumbling as controlled maneuvers (see http://www.youtube.com/watch?v=P9c0zWkLZ6c).

This is not possible with hang gliders due to the speed of rotation (http://www.youtube.com/watch?v=yJ3aL1dEJ7w).

Cheers,

Mario Campanella

Newly formed yahoo group for Kasperwing motorglider ultralights & rigid wing hang gliders and related aircraft.

http://groups.yahoo.com/group/Kasperwing/

It will be tightly monitored at first to avoid spammers, scammers, flamers & trolls. Please check it out.

Dan Moser

Hi.

I am looking for NORTHROP N9M-A Flying wing Electric span 75". Maybe you have other propositions, like Plans of Flying Wings with wing spam over 2 metres.

If anyone can help me, please write to me ASAP directly to e-mail : mnazimek@op.onet.pl

Sincerely

Martin Nazimek

Sound's like you are talking about Bill Young's N9M that was featured in Model Builder magazine. Plans are available:

http://www.geocities.com/aerohydro/mfm/northrop.htm

Mark Nankivil

There is a set on Ebay:
http://www.ebay.com/itm/RC-plans-NORTHROP-N9M-A-Flying-wing-Electric-span-75-/200848424581?pt=US_Character_Radio_Control_Toys&hash=item2ec37fbe85

for $15.00

There use to be several versions of plans for models of the N9M available from:
http://www.bellimelgroup.com/
However, I am not finding any at that web set at this time.

The Bell - Imel Group, LLC. Is based in Muncie, Indiana only a few miles from the Academy of Model Aeronautics' international headquarters, the Bell-Imel Group LLC specializes in the design and development of flying wing aircraft and low-power, high frequency communications systems.

LAST KNOWN CONTACT INFORMATION:
Jeff Imel
Vice President, Aviation Division
The Bell - Imel Group, LLC
765.748.4667
(Fax) 765.286.1912
http://www.bellimelgroup.com
jeffimel@bellimelgroup.com

He may still have some plans available.

Some other web locations to check out are:
http://home.planet.nl/~otten100/N9MPA.html

&
http://www.aviationtrivia.info/Northrop-N9M.php
(at the bottom of the page)

Let us know if any of this is useful.

Warren Bean

Mitchell U-2 Bulletin Board Thread

I am new to the group. My membership finally came through, after the "spam-bot"; invasion.

I have been looking into building my own plane for more than a year now, and have some interest in the U2 and B-10. There are a few questions I would like answered before deciding.

After going through all the pictures in the Photo section, I see that some of them show a tube frame inside the U-2. Is this standard? The U.S. Pacific website is lacking in some details like this, IMHO. It gives the impression that the U-2 is all wood.

I also see that there may be a problem with the spar/gear combination on a hard landing. Some builders seem to have found solutions to the problem. Are these modifications documented somewhere?

A major concern: I have a 2.5 car garage to build in---plenty of room. But it has twin doors that are less than 8 feet wide. If I build a U-2, will I be able to get it out? I assume that the wings on the B-10 can be removed, so it should not be a problem.

How is the safety record on the two? "Better-Half" thinks the B-10 does not look safe, even with an enclosed pod. Are ideas for the pod included on the plans? Personally, I like the B-10 because of the visibility, and it is really close to what I was thinking of for designing my own.

On a scale of 1 to 10, with 1 being the easiest, how hard is it for a first time builder to build these? Looks to me that the B-10 would be easier, even if I built an enclosed pod. On the same scale, how well do they handle in the air? Crosswinds?

Thanks!

Jim Bolinger

Hi, Jim--

Most "wooden" airplanes have steel tube framed fuselages because of the stress concentrations there, also a wooden frame is actually much more complex to design and build with little weight savings. Mitchell also designed with foam plastic ribs which are a big time saver compared to built-up wooden ribs. The wings fold just like the B-10. This PDF in the files directory shows some ways that other builders have addressed the landing gear problem:
http://groups.yahoo.com/group/U-2Wing/files/spar-problems.pdf

Norm Masters

AVAILABLE PLANS & REFERENCE MATERIAL

Tailless Aircraft Bibliography

My book containing several thousand annotated entries and appendices listing well over three hundred tailless designers/creators and their aircraft is no longer in print. I expect *eventually* to make available on disc a fairly comprehensive annotated and perhaps illustrated listing of pre-21st century tailless and related-interest aircraft documents in PDF format. Meanwhile, I will continue to provide information from my files to serious researchers. I'm sorry for the continuing delay, but life happens.

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

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 brucehcarmichael@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 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

FLYING WING SALES

BLUEPRINTS – Available for the Mitchell Wing Model U-2 Superwing Experimental motor glider and the B-10 Ultralight motor glider. These two aircraft were designed by Don Mitchell and are considered by many to be the finest flying wing airplanes available. The complete drawings, which include instructions, constructions photos and a flight manual cost $250 US delivery, $280 foreign delivery, postage paid.

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