No. 331 JANUARY 2014

T.W.I.T.T. NEWSLETTER

13 Foot Wingspan Flying Wing - Built from my own plans. Eppler 334 airfoil. 15 pounds with 6S 5000 mah lipo batteries. 50-65 brushless outrunner, 50 amp ESC, seven channels [elevons(2), throttle(ESC), pneumatic retracts(1), nose steering(1), drag rudders(2)] FLOWN Source: http://www.chrisgood.com/rcplanes/

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., **1401** means this is your last issue unless renewed.

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.

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Meetings are held on the third Saturday of every other month (beginning with January), at 1:30 PM, at Hanger A-4, Gillespie Field, El Cajon, California (first row of hangers on the south end of Joe Crosson Drive (#1720), east side of Gillespie or Skid Row for those flying in).

TABLE OF CONTENTS

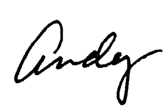
PRESIDENT'S CORNER

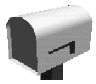
I hope everyone had a great holiday season with family and friends and that you had a Happy New Year celebration without a resultant hangover. We had our usual Christmas Eve dinner and gift exchange with family and some mutual friends around a well-decorated tree (thanks to my wife). The New Year was brought in quietly with some friends watching the Times Square ball descend but 3-hours later to account for west coast time.

This issue continues the reduction in the number of pages due to the lack of anything coming in from the membership on projects or new discoveries on flying wing aircraft development. I would certainly prefer having new material coming in from you folks that we can share to help others that might be experimenting in the same area. However, without it the best I can do is push discussions from the Nurflugel group that cover an area of interest at the time.

My apologies to those of you who subscribe to the Nurflugel discussion group since this becomes duplicative for you. However, we do have members that don't see this information and my hope is always that it will promote further discussion among our membership beyond what has been presented by the Nurflugel group.

HAPPY NEW YEAR





LETTERS TO THE EDITOR

Dear Andy!

A Merry Christmas and a Happy New Year, to you and our friends of flying wings and TWITT!

2013 comes to an end and I hope it brought mainly good things. With Christmas coming we have the first snow, and it is time to reflect the year.

The flying wing idea is still alive and TWITT takes a good part of it. Thank you for doing such a great job.

With my best wishes,

Reinhold Stadler

(ed. – This usually comes in after I have published the December issue, so here is his greetings albeit a little late. He also includes an electronic card but for some reason this year I couldn't get it to copy for inclusion here.)

Nurflugel Threads (continued)

Roger,

Regarding:
>Don't most all wings have some yaw stability problems, unless you >twist the bejesus out of them?

Not necessarily. A BSLD doesn't have yaw problems, and although those can in many cases have a lot of twist, there are variations that do not.

Steve, regarding "eddy flaps", not sure what you're referring to. Could you please elaborate?

A big thing you have to be careful of is failure modes. You're talking about using electric ducted fans as a primary flight control, and those (and their associated power sources and wiring) do not exactly have a safety-of-flight-worthy failure rate. You could easily find yourself with a "hard-over" control system failure.

As far as flaps to improve turning radius while thermalling, most flaps that are going to make a substantial difference also come with a big drag increase, which kills your L/D and sink rate. It's a tradeoff, and if you aren't careful, you could find yourself on the losing side of that tradeoff. A little bit of camber increase could have minor benefits. However, turning radius is a function of airspeed, and airspeed depends on lift coefficient, so a big change in turning radius requires a big change in lift coefficient, which is difficult to accomplish without a significant change in drag coefficient. In the end, it's all about efficiency.

liteflyt asks:

>Could you please expand on those BSLD's systems that don't have large twist.

A BSLD is a distribution of lift along the wing, nothing more. It's the result of a combination of parameters, geometric twist being only one of those. Some of the other parameters include planform (taper, which does not have to be constant along the span), aerodynamic twist (airfoil variations along the span), and (for off-design-point flight conditions) differential deflections of control surfaces (which, technically speaking, is a form of altering the effective twist). I have tested BSLD's successfully that used only a few degrees or less of geometric twist.

It's entirely possible to implement a BSLD through planform alone, with constant airfoil along the span and zero twist (and I have tested that), and in fact it's my understanding that when Prandtl and R.T. Jones each first studied BSLD's for the induced drag benefits, they were initially looking at implementing it through planform alone. However, the tips tend to end up being ridiculously long and slender, with the associated Reynolds number and structural issues. It does appear that to reap the full benefits of the effect on adverse yaw there does need to be some twist, but the amount does not have to be huge.

Steve, regarding your "eddy flaps", we need to make the distinction between thermalling vs landing. High drag and high lift coefficients are both beneficial in the final stages of landing, including for birds. However, thermalling is another matter entirely. The fundamental requirement in thermalling is that your sink rate must be no greater than the vertical speed of the air in the thermal. Your sink rate is equal to your airspeed times the sine of your gliding angle, which depends on your L/D. The problem is that if your method of improving your lift coefficient results in an equal or greater increase in drag, the glide angle worsens by a greater proportion than the decrease in airspeed, and your sink rate gets worse. Since the eddy flaps do their work post-stall (they require reversed flow to open them, which is something that normally only happens after stall), the L/D is going to be truly awful, possibly in the low single digits, and therefore the sink rate will also be very high. It's doubtful that your airspeed and turning radius will decrease enough to get you into a stronger part of the thermal to a degree that will make up for the increase in your sink rate.

Don Stackhouse

Eddy Flaps aren't flaps in the usual sense. I'm trying to think of another term that might be more intuitive, "vortex gate" comes to mind, 'automatically deployed spanwise fence', that's a mouthful, I guess for now 'eddy flaps' will do, and I suppose the inventor has first dibs on it.

http://www.bionik.tu-berlin.de/user/giani/vortrag/sld005.htm

It seems the key to making them work properly is their porosity, they used silk, which would be fine 'til it gets wet, but they anticipate that and show the use of a perforated plastic film.

As best as I've been able to determine, no "real world" testing has been done, but wind tunnel tests show enough promise to justify trying them on an existing platform, i.e. my Harrier, or Karn's old Gemini, or that 165 Dream I traded to him for a toy airplane.

These are all single-surface gliders, ideally suited to sand dune flying. I feel an excitement, like I'm doing something that may be beneficial in some way. Of course, it could end up being a total waste of time. I want to make up a bunch of these things and try them at various locations on the upper surface of the sail, and speaking of sails, maybe the sailing world could get something out of the experiments. Ya just never now, life is like a box of chocolates.

These 'flaps'; are supposed to reduce the amount of lift lost on a stalled wing, they were inspired by observation of birds, and are a man made version of the 'covert feathers' on the upper surface of birds.

So if they do prove to function as hoped for, what practical application could they have? Now THAT'S an interesting question, and I'm glad I asked it.

Well, there's the training environment, where having a reduced sink rate in the post-stall condition may have some benefit for safety reasons. And then of course there's thermal soaring, which often becomes a game of 'playing for position'. While many thermals are wide and allow for relatively easy soaring, many times they can be smaller in diameter and powerful to boot. I have often had to use extreme bank angles to stay in them. It was mentioned that it's 'all about efficiency', well I'll buy that, but when it comes to trying to grab that tiger by the tail, the term 'efficiency' just may require some definition.

A case in point is where being somewhat stalled in lift may be considered preferable to flying efficiently in sink. The idea being the slower you can go, the less bank angle needed to stay in that little patch of rising air that you desperately need to escape having a long hike out of a canyon to the nearest road, carrying a hundred pounds of gear.

If some aerodynamic devices like eddy flaps, vortex generators, alula feathers, and who knows what else can allow me to fly slower without losing lift, and if they don't add significant weight or complexity, I'm all for using them. There's been many, many times where I've deliberately stalled my inside wing, putting the glider in a spin for a quarter or half a circle, to momentarily tighten the turn and avoid getting shoved out of the lift. As I said, it boils down to playing for position, and I'd rather spin in lift for a moment than fly at best L/D in sink.

There are many things to consider, especially in the case of Nurflugel, where pitching moment can play a large part in the scheme. I have an informal plan of attack here. My thinking is to mount my Sony Handi-cam on a tri-pod, about half-way down the slope just to the side of the flight path, and have it zoomed in a bit on the landing spot. I will use short lengths of yarn taped all over the upper surface of the wing, fly over the target at about 10 feet and gradually push out into the stall, a gradual flare. I can then review the video frame-by-frame, and get some idea where to put the eddy flaps, by making a 'map' of the stall progression on the wing. Vortex generators will also be tried at various locations along the span, to see what if any effect they have on the tufts. Because the tests will be performed at low altitudes, and hopefully in a nice sea breeze that will lower ground speeds, I don't believe the danger element will be unacceptable, although thorough testing may mean fitting the devices on only one wing. I'll need to use extreme caution if asymmetrical experimenting is done, starting on the gentle slope near the bottom, I don't want to fly higher than I care to fall.

Hopefully we'll get a day or two with strong winds. This

will allow un-manned tethered flight, a sort of wind tunnel courtesy of Ma nature.
I expect to perform these tests in the next 60 to 90 days. Wish me luck, and PLEASE chime in here with constructive criticism and suggestions.

http://thehuwaldtfamily.org/jtrl/research/Flexible%20Flaps%20for%20Separation%20Control%20(Covert%20Flaps).pdf

http://www.bionik.tu-berlin.de/user/giani/vortrag/sld005.htm

Steve Corbin

Birds have been using "eddy flaps" for eons. For a beautiful explanatory photo, see the back cover of the August issue of RC Soaring Digest...

"Coming in for a landing." Great Blue Heron photographed by Charlie Morey, Charlie Morey Fine Art Photography, charliemorey.com. Lifted feathers prevent the air backflow from reaching the wing leading edge. Nikon D800E, ISO 400, 1/1600 sec., f8.0, 380mm"

Bill and Bunny Kuhlman

Some great insights as always, just to clarify a point when you say " I have tested BSLD's successfully that used only a few degrees or less of geometric twist." Do you mean that these wings did not suffer adverse yaw or just that they gave low induced drag or both?

John

Thanks, Don.

Rather what I thought, but I am having issues correlating BSLD 's use with proverse yaw.

Personal preference is to counter adverse yaw without extreme (to me) wing twist. So far ,I see spoilers, split flaps, and extreme twist used to trim out adverse yaw.

All add drag differential as the counter .

That's where the vectored thrust kernel rose from.

Could be the loss of thrust from the off axis vector is the same as the loss from drag systems.....or not..

However servoed vectored thrust can be used to actively trim the pitch axis also.

To me, it means that the all-wing control surfaces can be set for fared ,least drag cruse condition and trim drag iterations do not reduce average efficiency.

Thanks again Don

Rodger

I don't have the theoretical expertise necessary to refute anything you say on that level. Compared to most on this and other aeronautical discussion groups, I am relatively uneducated, although I did graduate from Spartan with an A&P certificate.

I do know, from experience, that while thermal soaring in hang gliders, that it is beneficial to be semi-stalled in lift as opposed to be flying efficiently in sink.

Many, many times while thermalling, I have been able to create a mental image "map" of the thermal. I learn where in the thermal the strongest lift is, I learn just where the "edges" are, and sometimes I learn just where it is that I need to tighten up my turn radius to avoid getting "spit out" of the thermal.

Often these thermals are small, and once spit out of them it's possible to lose a bunch of height while trying to find it again. the experienced pilot knows full well that staying in is much better than getting kicked out, and if staying in means a quarter or half-turn spin to do so, well, sometimes a man's gotta do what a man's gotta do.

My wings-level sink rate is somewhere in the neighborhood of 160 to 200 FPM, I don't really know for sure, as I don't fly with any instruments, finding them to be a distracting nuisance; doing it by feel, while not as effective as using instruments, is considerably more enjoyable.

Yes, I guess I'm an eccentric, all my friends use varios and don't seem to mind doing so, but for me I just need a good wing. My Sensor 610 with variable geometry and flaps fits the bill, as does the Harrier 187.

So I don't know what my sink rate is while performing a quarter to half-turn spin to keep from being tossed out. I don't think the increase is all that relevant, seeings how the maneuver will keep me in the 600+ fpm lift, lasts only a second or two, and continuing to fly the glider at best L/D will instead have me circling around in sink trying desperately to re-locate the thermal.

Theory is important, I study it as best as a math-challenged person can. But the actual experience of challenging and (sometimes) actually conquering these often difficult rising columns of air with what is admittedly a rather primitive aircraft (as opposed to those beautiful sailplanes) has taught me what "efficiency" really is. It boils down to staying up, or roasting in a hot LZ watching your friends soar in the cool air. And staying up might mean using a little trickery on occasion.

Steve

Vectored Thrust

One result with a vectored thrust experiment:

http://www.youtube.com/watch?v=Hz1dFsYwkL8

Rodger

Vectored thrust is a fine idea, if properly executed. To use it for directional control, for a Nurflugel pure flying wing, I would suggest using two motors (or more, if it's a scale YB-35). In this video it appears to me that the thrustline doesn't move all that far from the center of mass, so it has little effect in the yaw axis. The thrustline, when displaced from the centerline, will result in a slip or skid. At that point, a dihedral or anhedral built into the airframe will respond to the slip/skid and cause a roll.

In the beginning of the video, the inventors mention a lack of directional control when coming in for a landing, and suggest using vectored thrust. They state, correctly, that to turn they need to bank the aircraft, and by that I get the idea that they want to change the direction of flight without having to bank. Well, that's not a big deal to do. If the airframe has directional stability it will try to point into the apparent (relative) wind.

I think most of us here have seen the videos of the so-called "3D" flying, where the aircraft can remain wings level while performing curved flight. All that is required is some sort of aerodynamic device, such as a tall fuselage, to create the side force necessary to counter centrifugal force. Perhaps we could call such devices "centripital force generators".

This brings up one of the unique features of a Nurflugel, or pure flying wing, which seems to be what brings us all together.

A pure flying wing, with the correct dihedral/anhedral built in, does not pay much, if any, penalty for skidding or slipping. Much is said on this forum and others about the so-called "adverse yaw". I suppose that in the internet virtual world "adverse yaw" might be a problem, but out in the physical world, it isn't considered to be much of a problem at all.

When a pure Nurflugel is skidding/slipping, there's no fuselage to create drag. All that happens is that one wing is enjoying either more or less sweep than the other wing, so the effect on performance is possibly negligible.

My full-scale Nurflugels are powered by gravity, so If I shift that gravitational pull to the left wing, that wing will have more power than the right wing. It will advance forward of the less-powered right wing, causing what most will refer to as "adverse yaw". However, since the Nurflugel I'm referring to has just a tad of anhedral built in, it will roll to the left, which is nice, seeings how that's what I wanted.

Perhaps it would be appropriate to consider a new term for this yaw. instead of "adverse", which has a negative connotation, let's come up with a new term, "advantageous" yaw. If a yaw, or actually a slip/skid, is working in my favor, I would refer to it as "advantageous".

Just the other day I was enjoying a dance with a friendly thermal. It being wintertime, this thermal wasn't very powerful overall, but did on occasion put up a "core" that wanted to lift my inside wing and send me packing. But I was able to get the inside wing back down into that surge and get some much appreciated height gain out of it. I must say that this was a very entertaining experience.

I bring it up because for some time now I have been entertaining the idea of in-flight variable dihedral/anhedral. For example, let's say I'm thermalling in a right hand turn direction. My glider is a pure Nurflugel, and so has only enough directional stability to get the job done. That's fine by me, because a slip or skid really has no negative effect because I can "yaw" my body to streamline it with the airflow, although I must admit to not really caring too much about it. At the low airspeed of maybe 20 mph I don't think that drag is that big a deal, and being a laid-back type "B" personality It doesn't concern me much.

So I'm circling to the right, and the glider is yawed slightly to the left. If, when the core of the thermal tries to lift my right wing, I could at that moment increase my anhedral, then the glider would, I believe, try to lower the right wing.

I bring it up because there have been times where I couldn't keep the inside wing down, and got spit out of the thermal. In this case I usually just go with the flow, and 270 back into where I think/hope the thermal is.

That's Ok, but it would be nice if I could momentarily increase the anhedral enough to get the inside wing down and not get spit out.

Somewhere in my hang glider graveyard under the house is a folding base tube, that's the horizontal part of the triangular control bar employed by 99.9% of the HG's built.

Now this base tube has a sleeve, that slides over the hinge and locks it into a straight position. The reason it folds is to allow a slightly more convenient packing up of the glider after flight, and a slightly quicker set-up time at the launch site.

So anyway, if I can adapt that folding tube to my present love, either the Sensor or the Harrier (I tend to be a bit promiscuous), I can while thermalling slide the sleeve out of the locked position, and then push the center of the tube down, effectively shortening my side bracing wires, and increasing the anhedral.

I just read the above, and recognize I got way off topic. I meant to mention that if these guys with the RC flying wing have the proper amount of anhedral, and no tip fins, then they can use a variable thrustline to move the airplane to the side, without banking. there's a lot they can do with their experiments, and I wish them luck. I only fly using gravity as a power source and height as a fuel supply, so I can't help them much.

For those that might be offended by my rambling, I offer an apology. But I'm gonna blame it on the NyQuil.

Steve Corbin

Regarding the video, the commentary tells me that the authors have a poor understanding of basic flight mechanics.

Regarding Steve's comment:
>A pure flying wing, with the correct dihedral/anhedral built in, does not >pay much, if any, penalty for skidding or slipping.

That depends on what sort of yaw stability and yaw-roll coupling characteristics the plane has.

I have a 2-meter flying wing (another company's kit) out in the barn that has absolutely horrible adverse yaw problems. It also has significant yaw-roll coupling. It has to be flown extremely gently. Any large roll input to the elevons results in a large yaw excursion the other way. This couples with the sweep to cause a roll moment opposite and roughly equal to the roll moment caused by the elevons, and the plane proceeds to fly along half-sideways, with at best a glacially slow response in roll. While this is happening, pitch control also becomes very weak. If the controls are then released suddenly, it goes into a series of large yaw oscillations that take quite a few cycles to damp out, during which the control response to pitch or roll commands is nearly nonexistent.

Any roll inputs have to be small and well in advance, and it helps to put the nose down while rolling. The dihedral effect (and therefore the yaw-roll coupling) of wing sweep is a function of the lift coefficient, so if you can approach a zero-G condition while rolling, the adverse yaw problem is significantly less severe.

The plane is a danger to itself and anything nearby. I have not flown it in years, and I have no desire to. It was a beast to build (and unnecessarily so, but that's another story), and even worse to fly.

Don Stackhouse

I really do hate being a wet blanket. But most implementations of thrust vectoring to correct flight mechanics problems with yaw control will not work in the real world. I must admit, there always exists the possibility that I am unaware of a simple implementation that could solve all of the issues, but I have yet to see it.

On approach, it is the usual custom to reduce power and reduce thrust. In a vectored solution this implies there is poor yaw control moment available. On take off, at high power settings, the opposite exists. With such a controller a gain schedule to deal with the current power setting is highly desirable.

One other consideration, the effect of the engine

exhaust plume acts as a blown flap, which negates some of the expected control power of the vectored thrust (something to remember).
If you require some data on this may I suggest you Google "thrust vectoring Albion Bowers". You should find several peer reviewed NASA technical papers/reports on the subject...

Again, there may be some additional action necessary to solve this. But a complex answer to a simple problem is probably not a good solution. At this point, why not simply add a tail? [ouch! I probably shouldn't have gone that far...]

Al Bowers

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.

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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.
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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

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

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