No. 251 MAY 2007

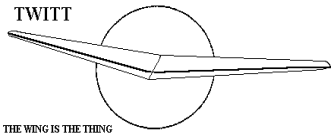
T.W.I.T.T. NEWSLETTER

French ace George Mix Madon, who had 41 dogfight victories in World War I, poses by the futuristic Simplex Arnoux racer of 1922. The pilot's vision forward and down was severely restricted by the Lamblin radiator perched on top of the fuselage and the expanse of the Arnoux "flying plank" Wing. Speed was 236 mph.
Source: http://www.century-of-flight.net/Aviation%20history/flying%20wings/europe_interwar.htm

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., **0705** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, May 19, 2007, 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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36oz/36	30.00	32.00	22.00
48oz/48	40.00	42.00	30.00
60oz/60	50.00	53.00	37.00

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

With the recent changes in the officer structure of TWITT, I think it also time to come to the realization that having programs even every other month probably just isn't going to happen. I don't have any of the aviation contacts that Bob and June had developed over the years, which was key to many of the programs that occurred. Additionally, we have just about used everyone in the aviation community that could do a presentation related to flying wings, some of them multiple times. When this is coupled with the fact that we can't over any reimbursement for traveling expenses, the number of potential speakers gets even smaller. I have also noticed at the last couple of programs that the number of people attending has shrunk due to the travel distance and longer commute times due to traffic. This is fair to a speaker if we can't consistently produce audiences of at least 15-20 people.

So, for the foreseeable future, don't expect there to be any formal programs at the hanger. This will not affect the monthly production of the newsletter and the functioning of TWITT as a clearinghouse for flying wing discussions by our members and others who care to participate.

So I will get back on my soapbox and plea with our members to please send in articles, pictures, web links, etc., etc., etc., that I can use in the newsletter. This is really what the organization is all about anyway, members sharing with members. I can always pull information threads from the Nurflugel bulletin board and some from the Mitchell U-2/B-10 bulletin board, but this is just not the same as using stuff from our members that often includes pictures of projects. If I haven't learned anything from editing aviation newsletters, it is that you guys really like pictures. The more the better from what I see.

I look forward to hearing from all of you in the months ahead.

Andy

MAY 19, 2007 PROGRAM

Since I haven't really had any spare time of late, I wasn't able to work on putting a program together for this month.

As usual, you are more than welcome to come by the hanger at meeting time to just visit and look around the airport. I will be there at the usual time to sign the local area aircraft owner's property tax display forms and could always use the company

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LETTERS TO THE EDITOR

April 1. 2007

Membership Renewal

As noted in my previous e-mail I have included my subscription for the next two years.

Thank you for the contribution you do the flying wing idea. Even if I cannot be active at the moment, I always follow the TWITT Newsletter with high interest.

Best regards,

Reinhold Stadler
Karlsfeld, German

(ed. – Thank you for the renewal and I am glad you find the information contained in the newsletters interesting each month.

I also wanted to use the renewal to remind our members that we now have the ability to send in your subscriptions electronically using the PayPal link on the web site. You don't need a PayPal account since there is an option for using your own credit card. I have been using PayPal for other organizations for a number of years and have never had a problem with security or the payment getting through to the intended payee. I will be updating it in the near future to allow for multiple year subscriptions, like this one, so you won't have to do two postings.)

April 2, 2007

Subject: Birds for Sale?

Hi Bob, this is Roberto from Italy.

I was looking at your wonderful birds and wondering if you sell some of them or if they are just your private collection?

Ciao

Roberto Mettifogo
<robbie@robertomettifogo.com>

April 16, 2007

Subject: Bird Fly

Hello Bob,

I am Robert Musters from the Netherlands. I found your gliders on the web and they are wonderful! I never have seen before that you can maneuver by the "tip feathers". I am trying to make "birds" as well. I feel I found somebody with the same passion. I just use flexible flapping wings to make more realistic. Enclosed I sent you some pictures of my experiments.

Wish you a wonderful day,

Robert Musters.
<bluefalcon@home.nl>

(ed. – It is interesting that there is still a lot of interest in Bob's radio controlled bird models. In the past Bob had not had any intention of providing plans, although the Vulture did show up in a modeling magazine once.

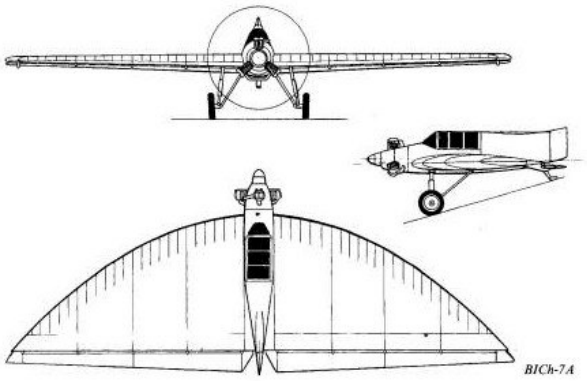
Unfortunately, as of this printing I haven't been able to recover my lost e-mail files that included the pictures that were sent along and I hadn't saved them to the hard drive yet. I am still trying various methods to retrieve all the data and will include the pictures at a later date.)

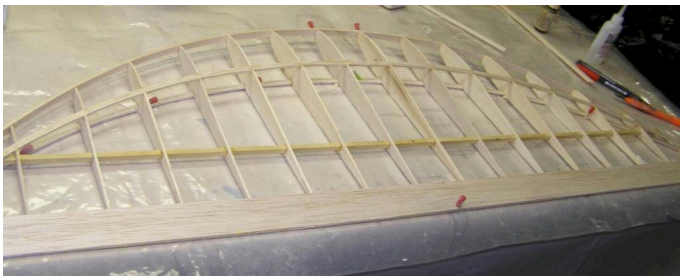
April 2, 2007

While looking up contacts that would want to know about Stefan's (Brochocki) passing I ran across a couple of model FW build threads that may provide some material for the newsletter.

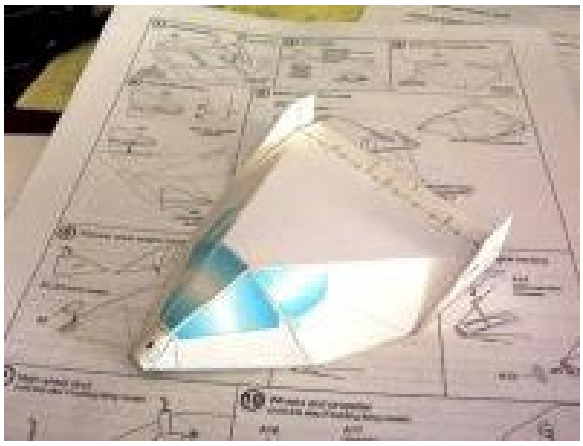
Laddie Mikulasko, who built a model BKB-1 some time ago, recently built a Cheranovsky BICh-7:

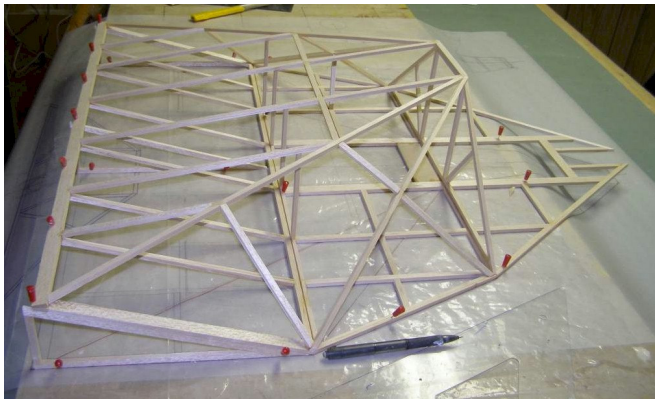
<http://www.rcgroups.com/forums/showthread.php?t=650748>





and a Facitmobil:
<http://www.rcgroups.com/forums/showthread.php?t=643496>





Ken Bates has reintroduced the Windlord plank glider. He included a comment in the build log about his BKB-1 models:
<http://www.rcgroups.com/forums/showthread.php?t=578473&page=5>

Ken Bates wrote: “I have built and flown MANY tailess designs in the lat 25 or so years, the highest aspectratio 16 to 1 Unswept it had pitch inertia issues, Monarch planeforms (forward sweep) had funny adverse yaw/ pitch issues with ailerons. The pictures of the Kasper wing many years ago got this all started, but soon I was shown Marsky's book and many prototypes later I arrived at the windlord
Recently I revisited the Kasper (Brochocki) wing and find it delightfull and easy to fly, being devoid of "issues"

The wind restriction was more for towing issues which may be solved with the current setup I.E. the "splaps" helped account for the pitch effect of the capture hooks, which helped prevent spitting of the bridle in gusty or heavy winch pulsing conditions, (and prevented a good cg ballast tube) Which produced a lot of drag, which meant lower tows in wind than the competition.

Currently the optimum CG is futher back than the original plans which show a conservative, reliable CG. I fly with the CG at 1/16 ahead of the 3/8 width spar, centered at the former spars location (1/8 for 1/4 wide - centered). This CG is beginning to show a bit of divergence, but is a very good LD and sink position. for wind you want it a bit further ahead so there is a bit more static margin for turbulence.”

Norman Masters
<nmasters@acsol.net>

(ed. Thanks for the links. I have added some of the pictures I found on the web sites to share with the rest of the members.)

April 24, 2007

Thanks for sending me the extra issue of TWITT. I got myself into several projects at the same time and forgot my TWITT membership. I'm enclosing a check for two years of membership. Maybe my life will he a bit less hectic in a coupe years.

I am also enclosing a drawing of the aerodynamic testing boom I have been using to evaluate my configurations of the original ARUP design. Although it looks a bit complicated it is easy and cheap to make. It has been a very effective tool for me.

I am not an RC modeler. For me, the RC model is only a quick and cheap way to test my ideas. I found that the free flying models didn't produce enough info for the time and money I spent making or repairing them. Two models crashed on takeoff. Three-second flights didn't produce much info. When we did get them into the air the models would be doing their thing 100+ feet out there while we tried to figure out their aerial gyrations.

The boom attaches to the front bumper and grill anchors of my GMC van. I used EMT tubing and mild steel scraps for the basic structure. Use 4130 or thicker wall steel tubing for the vertical axle that holds the model to the end of the boom. It needs to he strong when the model hits the upper stop. The sliding lead shot loaded tube allows us to change the weight of the model quickly and easily between test runs. Model can he locked in certain positions to test certain aerodynamics.

We found a three man test team works well. The driver controls and calls out ground speeds. The cameraman videos each run through the windshield. The pilot maneuvers the model from the passenger seat.

We preplan and log every run. Depending on our goals for the day, the log columns will differ for each test session such as date/time, air temp, cg position, model/boom anchor position, angle of attack, ground speed, wind angle, direction of run, liftoff speed, control effectiveness speed, etc.

Al the end of each run the crew reviews the mini-cam videos and discusses the model's behavior. Their remarks and any modifications of the model or boom are notated. We usually make a run in the opposite direction to substantiate our findings.

Some advantages of this system are: Up-close observation of the model during test runs and repeated viewing of the runs later; Lots of control of aerodynamic conditions; Many tests can he accomplished in a short time; Model survival is excellent; No expense and complications of a power pack; Tests can be done on any 1 mile piece of straight and level road (quiet country preferred).

We spent 5 afternoons during a 4-week period actually testing. Most of the rest of that time was spent modifying the model. The model is a strong lifter. It is quite stable and controllable in pitch and yaw mode. We found that the airflow around our modified ARUP configuration behaved just as the old NACA report said it should. But we had a roll control problem. We have explored several roll control systems and are building a model to test one we hope will solve that problem. If it works I'll write an article about that struggle.
Good luck to you, Andy, and all other TWITTS!!!!!

Sincerely.

Jim Loyd
Thornton, CO

(ed. – Thank you for the update on how your project is progressing. I have included the diagram on the following page.

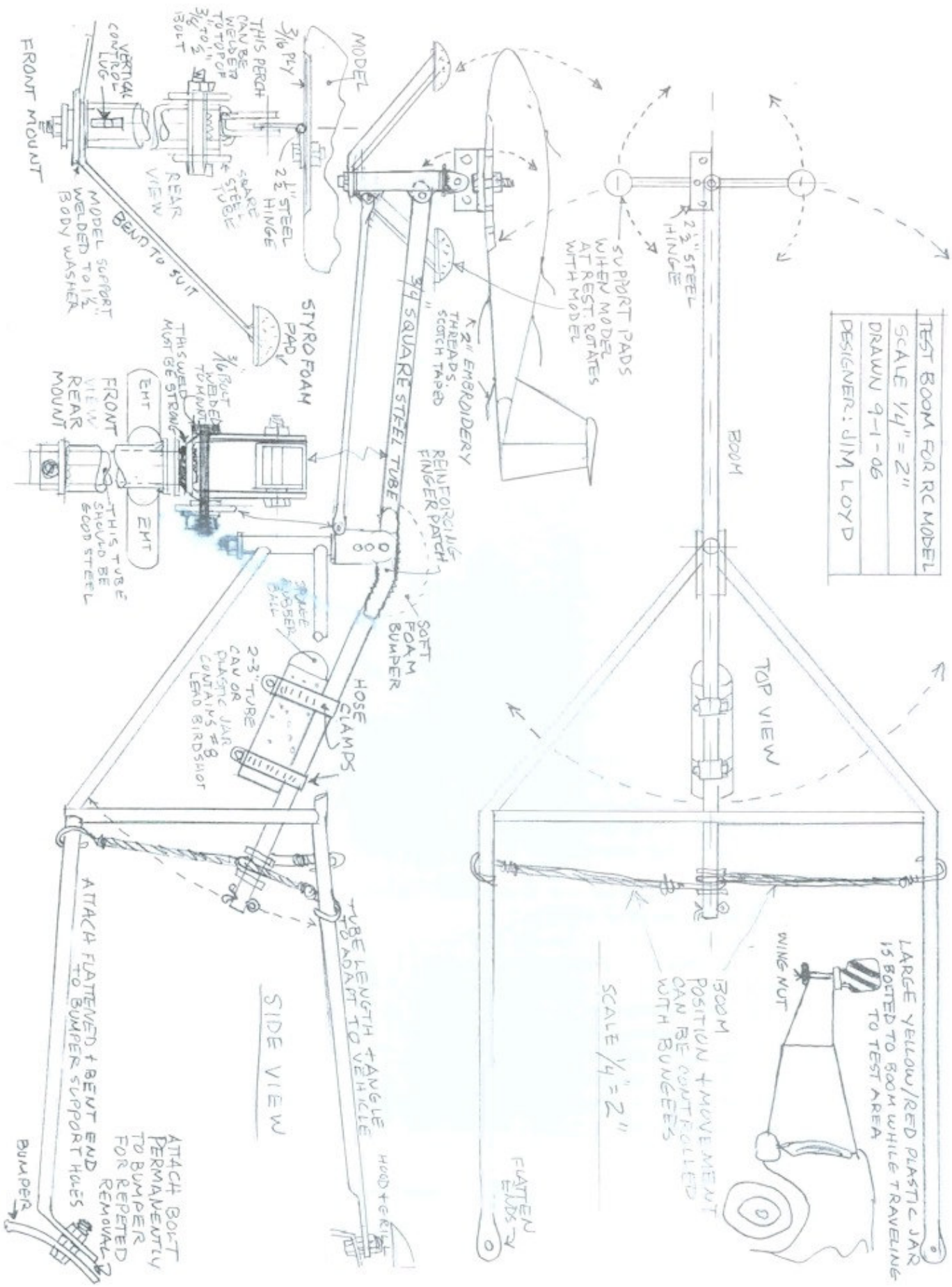
I find it interesting that we have two divergent philosophies on how to best test a new design's attributes. There are those that believe the quickest and best way is to build scale models and fly multiple flights observing the results. Jim has obviously found that to be a much less efficient method of testing with his rig providing much better empirical data from which to make design changes. Each method has its pluses and minuses, and I image some of it depends on the available resources like material and time.)

From Larry Nicholson we received an announcement of an aviation book that perhaps some of you might want to acquire. Although not about flying wings, I know we have a lot of aviation history buffs out there so I am passing the information along.

The Royal Air Force in Oklahoma, by Paula Carmack Denson, published by the Oklahoma Heritage Association as part of the Horizon Series, December 2006, hundreds of photos, indexed and fully documented. ISBN 978-1-885596-7, $29.95 + tax, shipping & handling. PayPay accepted through http://www.pkdenson.com/raf_okla.

From George Green we received an announcement of his book that includes a short section on multimodal vehicles that have the ability to traverse land, water and air. It appears the air vehicles may include things like the Waterman AeroMobile.

Special Use Vehicles – An Illustrated History of Unconventional Cars and Trucks Worldwide, by


TEST BOOM FOR RC MODEL
SCALE 1/4" = 2"
DRAWN 9-1-06
DESIGNER: JIM LOYD
SIDE VIEW
TOP VIEW
REAR VIEW
FRONT VIEW
MODEL
BOOM
STYRO FOAM PAD
3/4 SQUARE STEEL TUBE
SOFT FOAM BUMPER
HOSE CLAMPS
BUMPER
FLATTEN ENDS
SCALE 1/4" = 2"
WING NUT
LARGE YELLOW/RED PLASTIC JAR IS BOLTED TO BOOM WHILE TRAVELING TO TEST AREA
BOOM POSITION + MOVEMENT CAN BE CONTROLLED WITH BUNGEES
ORIGINAL - FILE COPY

George W. Green, published by McFarland & Company, 248 pages, 153 photos, appendix, glossary and index, 2006. ISBN 0-7864-2911-9, $35 + $4 shipping and handling. 1-800-253-2187, www.mcfarlandpub.com.

Nurflugel Bulletin Board Threads:

April 17, 2007

Calculating Wing Twist With Panknin

I am new to this group, and I have a question for you already about wing twist for a swept wing model, in particular using the Panknin formula. I have not been able to find a satisfactory answer anywhere about the amount of geometric twist this formula predicts – for example, lets say the formal predicts 3.5 degrees of total twist across the panel. At what incidence should the root airfoil be set at in relation to the angle of zero lift of the chosen airfoil section? Then the tip airfoil I assume should be set at 3.5 degrees less than the root airfoil, in relation to the angle of zero lift?

Thanks for your help

Chris Doughty
<chris.doughty1@gmail.com>

Your assumption is quite correct, but why don't you use a modern reflexed wing profile instead of twisting the wing? It is far more efficient and works much better. You can have a straight or even slightly swept forward wing configuration (instead of the old and less efficient swept back). See http://www.continuo.com/marske/index.htm. For working and creating profiles and more, I warmly suggest for you to use the PROFILI 2 software (http://www.profili2.com), which I and many others consider to be the best available.

Bruno

Bruno, Thanks for the advice, that is certainly something to think about. However, if I was to use sweepback with twist, how do you determine the incidence to set the root airfoil at?

Chris

It will definitely depend on the profile, but in general the root chord of the wing will seat at a certain AoA depending on the amount of geometric and aerodynamic twist used. In a flying wing with a common profile (even a Clark Y or V) the twist between root chord and tip chord can vary from 3 to 5 degrees, depending on the wing's plan form and aspect ratio.

Need name here

I add that every flying wing, if not coerced by variations in trim and control, will naturally seat, in flight, at an AoA determined by the total result of twist, profiles, plan form etc., as any other aircraft. So the root airfoil will be setting itself at a flying incidence.

<msmprod@optushome.com.au>

Ah OK. I wondered if that might be the answer. It sounds true in most cases, although for instance, if your root was at say, -15 degrees and your tips were at -18 degrees, for a total of 3 degrees twist, I have a feeling flight characteristics may be less than desirable!

BTW - I have profilipro V2, and it is an outstanding program.

Chris

Unless one purposely uses full elevator and/or the position of the CG is too far back, that will not happen. See, the Marske Pioneer and Monarch can be flown, KEEPING FULL CONTROL, with the stick completely back. It is not possible to do that with swept back wings. They will badly stall and lateral control will be lost.

<msmprod@optushome.com.au>

You guys are making this much too difficult.
Assume the datum line for the root airfoil is at zero degrees. Now twist the wing tip section so its datum line is at the correct angle to the root datum line.
The root section has no angle of incidence as such. Just assume it's always at zero degrees and set your wing tip section angle relative to it.
The Panknin formula was initially configured to have the twist start at the root and end at the wing tip. However, practical experience has shown you can start the twist half way out the semi-span and get the same results.

Bill & Bunny Kuhlman

I think you are making it too difficult as well.

Lets take two examples, one with a lot of twist/airfoil reflex with a forward CG and one with a small amount of twist/airfoil reflex and a more rearward CG. Both, given a properly adjusted CG, trim out at the same airspeed.

The difference is that the one with the large twist/reflex will have a much larger static restoring moment, i.e. static stability or tendency to return to the trimmed airspeed if disturbed. Large static stability is good, right? Not necessarily.

A large pitch restoring moment combined with the characteristically small pitch damping and the low drag coefficient of flying wings, will result in a highly divergent phugoid oscillation and an undamped pitch resonance at about 1-2 Hz. In other words, you will have a flying rocking horse - big time dynamic instability.

Since flying wings have a very small pitch damping moments and low drag, be very careful when selecting the pitching moment of the wing. One does well to make the static stability small enough that the available damping can deal with it. In simpler terms, use the smallest amount of twist or reflex you can get away with. This is especially true since, once the aircraft is built, it's hard to change.

However, if you discard this advice, you'll be in good company since most flying wing designers have made this mistake.

Bill Daniels

Correct me if I am wrong but it appears that people are missing the purpose which is to have the wing tips stall out first allowing a correction before a real stall is reached.

Best to all

Harry

All good points with respect to wing design, but I think the original question was much more basic.

Given a wing with a specified taper, airfoil, and twist distribution (sounded to me like the original question assumed the person had already "designed" the wing), to what angle should the root of the wing be set?

With the wing shape already specified, then calculate the CL on the total wing when the root is at negative (say -5deg) through positive (say +15deg) angles of attack.

Then go to your overall aircraft - whether flying wing or not – and figure out what CL the aircraft will be flying at for a typical/desired cruise condition. The angle of the root chord for that CL is the angle you should set your root chord relative to your fuselage. This then allows your fuselage (or seat enclosure if in a flying with with no fuselage) to be at a flat/zero angle when cruising, which will likely be most comfortable. (Note DC-9/MD-80s have very high fuselage angles at cruise which stewardesses really don't like when pushing a cart full of soda!!)

Then, check the angle of the airplane when on the gear for takeoff/landing, etc. to see if the specified angles work for the overall aircraft configuration. Repeat whole process until everything does work for the whole aircraft configuration.

Dennis

Assuming a swept back wing... No, you do not want that.

Imagine the wing tips as being the horizontal stabilizer on a conventional aircraft. You want the wing to stall before the stabilizer. You need the stabilizer to bring the wing angle of attack to a lower value. It can't do that if it's stalled.

On a swept back wing in a thermal turn, the stalled wing tip will be the inner one. That will increase drag on the inner wing and yaw the wing toward the circle center. This is not good.

We've talked with several German flying wing designers, and in the early days of swept wing tailless gliders (Elfe 2, JIT, CO2, etc.) there was some concern that the Eppler sections designed for wing tips, like the E 228 and E230, were shied away from because of their low CLmax.

Assuming a plan form with taper and no leading edge sweep (quarter chord line swept slightly forward)... This is where you want the tips to stall first. The example we have in mind is the Markse Monarch. There have been at least two pilots who have managed to get themselves into life-threatening situations in the Monarch by modifying the wing tip configuration in such a way that stalling was delayed. At high angles of attack, the root of the wing stalls, but the forward wing tips do not. The central elevator may or may not have enough power to bring the Monarch out of a deep stall in which the wing tips, without elevator function, are still flying and producing lift way ahead of the CG.

Hope that answers your concerns.

Bill & Bunny Kuhlman

OK, I'll weigh in here.

Speaking as a designer, we go to great lengths to make sure the tips do NOT stall first.

The problem is that airplanes are almost never perfectly symmetrical, and even if they were, the airflow around them is almost never perfectly symmetrical.

Because of this, if the tips stall first, then one tip will almost certainly stall before the other one. The immediate result of this is a sudden unbalance in both lift and drag that results in a roll towards the stalled tip, which induces a change in the local angles of attack at both tips, which keeps the stalled tip stalled, and the unstalled tip unstalled. We call this a snap roll. If it continues until the plane's flight path is approximately vertical, we call it a spin. If it continues until altitude relative to the ground, or "AGL") equals zero, we call it an accident statistic.

The other result of a tip stall is a loss of most (if not all) of your aileron authority, which doesn't help the situation. And, if the pilot reacts instinctively to the roll with some opposite aileron, they can exacerbate the stall at one tip, and make the situation even worse.

Furthermore, a stalled tip on an aft-swept wing (nurflugel or not) shifts the center of the remaining lift forwards, which tends to raise the nose, making the situation worse, usually much worse, very possibly unrecoverable.

On a forward-swept wing, a stalled tip would tend to trim the nose downwards, which would help mitigate the stall, but you still have the problem of one tip stalling before the other, and the uncommanded rolling and possible spinning. Still a bad idea. However, if the root stalls first (which is the natural tendency of a forward-swept wing, due to the span wise flow direction and the tendency for the lift distribution to shift towards the root), that tends to raise the nose and accentuate the stall, which is also bad.

One very clever fix for all of this, used by Jim Marske on his wings, is to make the elevators themselves (which are pushing the trailing edge downwards when trying to raise the nose) stall (or be blanketed in the first nibblings of separated flow from the root trailing edge region) before anything else. This eliminates the ability to increase the overall angle of attack any further, naturally making the wing aerodynamically "stall proof" (as opposed to mechanical stall proofing by physically limiting the elevator travel, such as in the Ercoupe).

Any way you cut it, tuning an aircraft for good handling is typically trickier than tuning for performance. On one of our designs, getting the handling "just right" typically consumes more than half the total aerodynamic design effort.

Don Stackhouse

Pioneer 1A at El Mirage Dry Lake November 1960

Posted by: Bill Daniels <BILDAN@COMCAST.NET>

I just posted a picture of Jim Marske's Pioneer 1A glider sitting on the El Mirage dry lake bed with me in the cockpit waiting for my turn on the auto tow wire. I flew the test flights of that glider at El Mirage in the late 1960's.

The P1A flying wing used a bridle fitted to two tow hooks on the side of the fuselage - there was also a nose hook but it was rarely used. The elevators are on the inboard TE and worked perfectly. There were no ailerons as we used spoilers for roll control. The rudder wasn't terribly effective despite its size. Later in the test flight program, proverse yaw created severe problems at high speed. This was the only Marske glider with roll spoilers.

We used 6000 feet of piano wire pulled by a big muscle car to launch the glider. That allowed me to launch the P1A to 3000 feet AGL fairly consistently. Virtually every flight was a soaring flight if any thermals were present.

This was desert soaring at its best.

Posted by: AL-n-PALMER <arobins1@midsouth.rr.com>

Wow Bill, way cool story.. Tell us some more about the yaw issues.. Spoiler float?

(how in the heck didja wind up that much piano wire?)

Jim said in a post a long time ago that there was a "dead band' in roll from the spoilers having to go thru (unpredictable?) boundary layer then it would grab. Jim said it worked but it was disconcerting. What did you see? Where were the roll spoilers placed? (I am

curious about this for my "back burner" nurflugel, Longshot)

FWIW: I built a parasol .90 4 stroker R/C sport model with spoilers for roll control as an experiment when "affordable" computer radios first came out in the mid 90's and I was delighted. It worked fine, zero adverse yaw but the differential gains and bell crank geometry did require some fine tuning. A micro switch in the (conventional) landing gear triggered both spoilers to deploy on touch down if the 6th ch was armed, a cute feature that actually worked quite well.

Hope everybody has a great day, I am on vacation and (trying to) work on finishing up N125PR. I now remember why I stopped building experimental aircraft 25 years ago. An exercise in frustration to say the least, it's never "good enough" you build 2 parts and throw away 3, I'd call it negative production numbers but in a perverse way it has been fun to beat it into submission and see a "one off" come along. PA-20's next then Longshot. I should be about ready to retire then.

Posted by: Bill Daniels

Proverse yaw due to roll spoilers occurs because the drag produced increases with the square of the airspeed but the roll effect stays constant with speed since it is just due to 'spoiling' the lift which remains equal to weight. At high speed, the roll spoiler effect is
99% yaw whereas near stall it is 99% roll. They would produce violent yawing as soon as the spoilers came open at high speed. There was a crossover point at about 60 knots where the roll and yaw were perfectly mixed so I could make a "feet-on-the-floor" turn entry.

Of course, roll spoilers should work better on a swept wing due to the yaw to roll coupling.

Jim is right about the "dead zone". It seemed that the spoilers wouldn't trip the flow until they were open about 1/2" - in fact, it seemed as though they actually increased the airfoil camber and lift until the flow tripped producing a slight reverse roll effect at the onset of spoiler input. Very disconcerting until I got used to it.

I adopted the control laws used by the F-111 which popped the roll spoilers wide open for a fraction of a second then closed them to the desired intermediate position. Of course, I had to do this manually by banging the stick to the side and bringing it back to the desired position.

The bottom line is that roll spoilers/airbrakes on the wing upper surface just don't work for attitude control for a lot of reasons no matter whether they are intended for yaw or roll control. I still like drag rudders for yaw control but not the kind that Northrup or the Hortons used. I'd suggest a drag rudder that opens into undisturbed air by extending spanwise from the wing tip.

Posted by: "msmprod" <msmprod@optushome.com.au>

I agree about the Northrop, but the Horten brothers experimented with
different configurations and achieved positive results.

Posted by: Norman Masters <nmasters@acsol.net>

On the H-IX yaw was controlled by two airbrakes on each tip that opened sequentially and a frise-type elevon. Dr Horten may have achieved better directional stability latter on with the BSLD but up till then directional control was just via airbrakes. They did try out several configurations including "tongues" on the first H-VII that fit behind the spar and slid out past the tips.

Posted by: Bill Daniels

I disagree.

I spoke with Rudy Opitz who flew several of the Horton wings. He thought the spoiler-type drag rudder was crap. The yaw spoiler was directly in front of the elevon which disrupted flow over it and made the control yoke shake like an impending stall. It also had a bad dead spot until the spoiler extended enough to reach up out of the stagnant boundary layer. When it did, it tripped the flow over a large section of span with an "all-or-nothing" effect.

However, the Hortens did experiment with a span-wise sliding section for yaw control in the Ho VII. Rudy thought that worked quite well but the Hortens never used it again. The span-wise sliding drag rudder is far more proportional in its effect and ultimately a far more powerful yaw device.

Rudy also complained about the difficulty in controlling the Ho IV's over banking in thermalling turns since the "bell shaped lift distribution curve" had eliminated the adverse yaw glider pilots find so useful.

To further explain this last point, remember that in a slow, tight turn used for thermalling, the spanwise distribution of lift and drag shifts toward the outside wing causing an over banking tendency. If the pilot holds a slight amount of aileron (or elevon) against the turn, this re-distributes the lift and the adverse yaw redistributes the drag restoring symmetry without the need for rudder input. This is particularly important when your rudder is a drag producing spoiler.

This is something almost all glider designers got right even without realizing it. It's only when you fly a glider without adverse yaw that you realize how important it is.

Posted by: "msmprod"

Incidentally, they were the HORTEN (not Horton) brothers.

Posted by: James Marske <marske@marion.net>

You fellas brought up some interesting topics. Yeah, I will never go the roll spoiler route again. Roll spoilers were used on the Pioneer 1 because of the dreadful aileron adverse yaw drag of the XM-1 Flying Plank. Actually, they were elevons. The neat thing about elevons is that you can experiment with differential ailerons in flight. (Are you getting
confused?) In slow flight the elevons are raised and roll input can be applied giving a neutral deflection on one side and lots up aileron on the other side. Would you believe there was still adverse yaw in the roll? Not as strong but it was there. So I thought roll spoilers would be the answer. Wrong. It introduced all kinds of undesirable side effects as Bill Daniels so well explained.

Speaking of floating roll spoilers - no this could not happen. I designed a cam drive for the spoiler system mounted in the fuselage. Bill had it milled out in the shop where he worked - nice job Bill (45 years late). The spoiler was locked closed by the cam drive and no air leaked out the spoiler flap. The spoiler was a door type hinged on the forward edge and opened to 45 degrees. A major irritation I had with the spoiler was the slamming door noise as you went quickly from left to right roll spoiler.

In defense of the Plank layout, a rectangular non-tapered planform, its stability in a turn was most impressive. I had been working a very weak but smooth thermal over Lake Elsinore, California. I had trimmed the speed, a bungee tensioned to the stick, to fly at 45 mph (73kph) my best minimum sink speed. The thermal was so smooth that it was not necessary to touch the stick for several minutes at a time. Minor turn adjustments were made with small inputs on the rudder pedals. To hold the turn constant in a 30-degree bank, the rudder drag flap on the lowered wing, had to be held open a small
amount, maybe 10 degrees. The turn was well coordinated and if I closed the drag flap I would roll out and fly straight. I don't believe I had any aileron input at all while circling to counteract the roll. I found this discovery very useful on one occasion when I was sucked up into cloud without blind flying instruments.

Getting back to the XM-1 Plank and split drag rudders, I really liked them. They were an extension of the elevons and were originally located right out to the wingtip. They were 12 x 24" (305 x 610mm) in size and they opened to 60 degrees. They required a pretty heavy force on the foot to open at 80mph (130kmh). Since they seemed to lose their effectiveness when opened more than 40 degrees I lengthened the flap horns to reduce the pedal load and limit the flap opening to 45 degrees. This worked great. Soon I learned to use the split drag flaps as air brakes to assist the landing flaps when landing. Both foot pedals pushed to the floor activated both split flaps. I like to add that the split flap had no dead spot due to boundary layer and had no time delay in effectiveness. I almost forgot an important point. With the yaw flaps at the extreme end of the wing the flaps were in the tip vorticies, which made them pretty ineffective. Adding a 12" (31cm) Horner type wingtip extension moved the tip vorticies outboard away from the rudder drag flap. Now all worked in harmony.

Bill Daniels flew the XM-1D quite a bit and may want to comment on my
reflections.

Posted by: "Bill Daniels"

I do seem to remember a dead spot in the XM-1 drag brakes but that's from 45 years ago. Maybe it was just that I had to push the pedal so hard.

I still like the idea of sliding an air brake out of the tip spanwise at right angles to the clean airflow. There wouldn't be any control forces at all just a return spring that wouldn't have to be very strong.

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