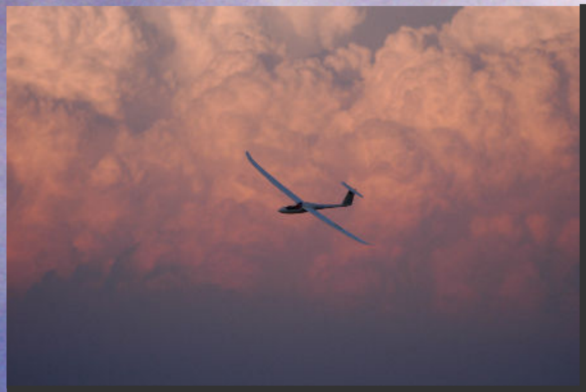
Radio Controlled

Soaring Digest

February 2006 — Vol. 23, No. 2

CONTENTS

February 2006
Vol. 23, No. 2



Front Cover — Mr. Leading Edge Gliders himself, Jack Cooper, doesn't always fly his own creations! Here is his 2-meter *Discus 2B* at sunset with a storm rolling in at the Wilson Lake Dam near Lucas, Kansas. Nikon D100, ISO 200, 200 mm,1/1000 sec. at f3.5.
Photo by Greg Smith, <www.slopeflyer.com>

Back cover: Scobie Putchler maneuvers his own-design Swyft against the backdrop of downtown Seattle and Lake Union. Konica KD-500Z, 8 mm, 1/1429 sec at f4.7, ISO 100.
Photo by Tord Eriksson and Ann-Christine Mathiasson

R/C Soaring Digest

Managing Editors, Publishers — B² Kuhlman

Columnists
Jay Decker
Lee Murray
Tom Nagel
Mark Nankivil
Steve Richman
Dave Register
Jerry Slates
Gordy Stahl
Peter Wick

Contributors
Dave Garwood
Don Bailey
Brent Douglas
Mark Drela
Matthieu Scherrer
Gregory Vasgerdsian

Photographers
Dave Garwood
Dave Beardsley
Mark Nankivil

Contact
rcsdigest@themacisp.net
<http://www.rcsoaringdigest.com>
Yahoo! group: RCSoaringDigest

R/C Soaring Digest (RCSD) is a reader-written monthly publication for the R/C sailplane enthusiast and has been published since January 1984. It is dedicated to sharing technical and educational information. All material contributed must be exclusive and original and not infringe upon the copyrights of others. It is the policy of RCSD to provide accurate information. Please let us know of any error that significantly affects the meaning of a story. Because we encourage new ideas, the content of each article is the opinion of the author and may not necessarily reflect those of RCSD. We encourage anyone who wishes to obtain additional information to contact the author.

Published by B2Streamlines.com

In the Air!

This issue of *RCSD* has fewer pages than recent issues, but don't let that fool you into thinking there may be any less information. In fact, with a quick glance at the Contents page, you can see this issue is filled with a wide variety of subjects from an international assembly of writers.

We encourage *RCSD* readers to take a look at their own participation in RC soaring and consider sharing some aspect of their passion with others. Submission guidelines are now available on-line as a PDF document. The URL is <http://www.rcsoaringdigest.com/pdfs/Submissions.pdf>

Lee Murray has been at work on the *RCSD* Index, and the results are already on-line. The entries for 1995 through 2005 are now available within a single RTF document which can be downloaded from <http://www.rcsoaringdigest.com/RCSDindex.html>. RTF documents are attractive when printed, and can be easily searched with text editing applications. We're also in the process of moving the web-based Index search engine from Greg Ciurpita's server to the web home of *RCSD*. If you have experience in setting up CGI scripts and would like to help with this transition, please contact us.

Reader response to the PayPal donation button on the *RCSD* web site has been extremely gratifying. Several readers have made small donations each month - sort of a self-imposed "per issue" arrangement - while others have made substantial one time contributions. We sincerely thank everyone who has participated in this program, regardless of monetary amount. Your support and continued readership are very much appreciated.

Time to build another sailplane!

How To Mask Paint With Frisket

by Dave Garwood, <DGarwood@nycap.rr.com>

Dave Garwood with *Warhawk* at Wilson Lake Kansas, after a few hard landings had deformed the EPP foam and flaked off some of the paint. Photo by Rich Loud.

This article describes how artist's "frisket" masking material can be used when painting details on a model airplane.

While frisket is often thought of an airbrusher's tool, it works just as well for spray can application of paint to small areas. The project described here is a Leading Edge Gliders 60-inch span P-40 *Warhawk*, finished in an American Volunteer Group "Flying Tigers" scheme. The P-40 is built from carved EPP foam and covered with Solartex iron-on fabric.

Frisket is a specialized adhesive film for masking sprayed paint, available from a local art supply store or by mail order. One dependable source is Dixie Art and Airbrush Supply <www.dixieart.com>.

The essential characteristics for our purposes are the material is impermeable to sprayed paint, sticks readily to already painted surfaces, pulls up cleanly without removing underlying paint or leaving a residue, and cuts cleanly and easily with a razor knife.

Frisket film is sold in sheets and rolls, offers a choice of shiny or matte working surface, and high-tack or low-tack adhesive. My personal preference is low-tack, matte film. Frisket lays out well on flat surfaces and single-curve surfaces, but a very limited ability to mask compound curve surfaces. For compound curves, you might want to try liquid masking film or Testors Model Master Parafilm (TM) masking material.

For the shark mouth markings on my *Warhawk* I used Grafix (TM) Prepared Frisket Film, low tack, matte finish, 0.002 vinyl. When painting small areas like the shark mouth, I find I can work far more accurately with a knife than with a brush. I can draw on the frisket film with Sharpie (TM) marker to make a cutting guide, and in case of a mistake, can easily pull the frisket off and start again with a new piece.

If you're new to frisket, start with a simple task like the tire markings on the underside of the wing. What I did was lay out the markings with a pencil compass after some of the major panel lines were drawn with Sanford Ultra Fine Sharpie (TM) marker. Then I applied frisket film to the underside of the wing, and cut out the tire marking areas out with a special compass which holds a blade, also available from the art supply store.

I masked off the rest of the wing leaving only the tire marking area exposed, took the wing outside and lightly sprayed the exposed areas with semi-gloss black paint directly from the can. When the paint was dry I applied the and decals and completed panel lines using a Sanford Ultra Fine Sharpie (TM) marker, rulers and plastic templates, referring to the 3-view drawings in the Squadron/Signal "Curtiss P-40 in Action" book.

Painting the shark's mouth was more involved as there were more colors and layers of paint, and finer details to mask and paint. If it looks daunting, consider making one or more practice panels to build your skills. Use as many practice panels as you need to check spray pattern from the cans, paint compatibility, paint color, and decal coverage. Use these panels for checking the performance of masking materials, both vinyl masking tape and frisket. Gain some experience with how the frisket lays down, cuts, and pulls up after paint is dry.

Another use of the paint test panels is to practice and refine your method for achieving the "feather edge" between the large areas of color on a military camouflage paint scheme. I'm moderately competent at feathering an edge with an airbrush, but less experienced at this technique with a spray can. The feather edge on Paint Test 2 was done with the spray can alone, making a smooth, fast pass with the spray can nozzle about 2-3 inches from the painted surface. For Paint Test 3, a cardboard mask was cut and held about 1/8 inch above the target surface. I liked the effect of the first method better, and used it on the P-40 finish.

After the main camouflage colors were applied, the canopy and spinner painted, I first applied the white paint for the teeth, masking with tape. Don't forget to cover all the rest of the model except for the small area to be painted. When the white paint has dried thoroughly, I covered the area with frisket and used Sharpie (TM) marker to draw a cutting guide. The areas that will receive the gray paint are removed with a hobby knife. Using a fresh blade allows precise cutting with minimum pressure to minimize cutting into the white paint. I sprayed medium gray paint, and after a few minutes removed the frisket, and let the gray dry overnight.

Next came the red paint, applied with a frisket mask just like the gray paint. Finally, I added the black markings around the shark's mouth with Sharpie (TM) marker, but it could be painted using frisket mask if you wish.

Take the time to draw panel lines, as they really dress up the plane with very little extra work. I use a Sanford Ultra Fine Sharpie (TM) marker, flexible plastic ruler, and plastic templates. Marker mistakes can be cleaned up with isopropyl alcohol. I like the three-view drawings in the Squadron/Signal "In Action" books for prototypical panel line placement.

Frisket quickly becomes another arrow in your quiver of techniques for modelers who like the details of their planes to look sharp, and for those who want a design or a size that's not available in decals.

Paint Colors Used on this P-40 *Warhawk*

Krylon 1318 All Purpose Primer Sandable Primer Gray

Tamiya AS-2 LIGHT GRAY (IJN) for underside

Tamiya AS-9 DARK GREEN (RAF) for upper side

Tamiya AS-15 TAN (USAF) for upper side

Tamiya TS-10 FRENCH BLUE for canopy

Tamiya TS-20 INSIGNIA WHITE for "68" numerals

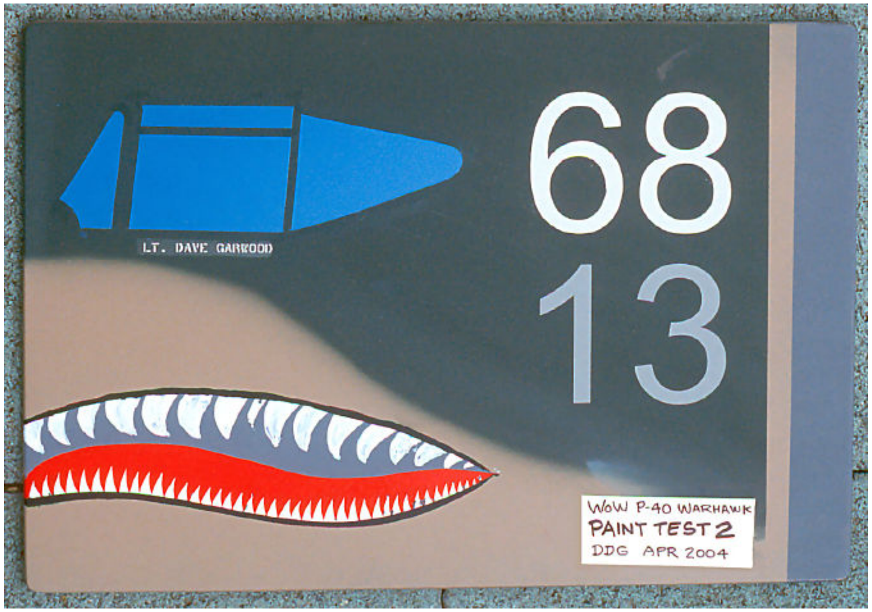
Tamiya TS-49 BRIGHT RED for spinner, shark mouth

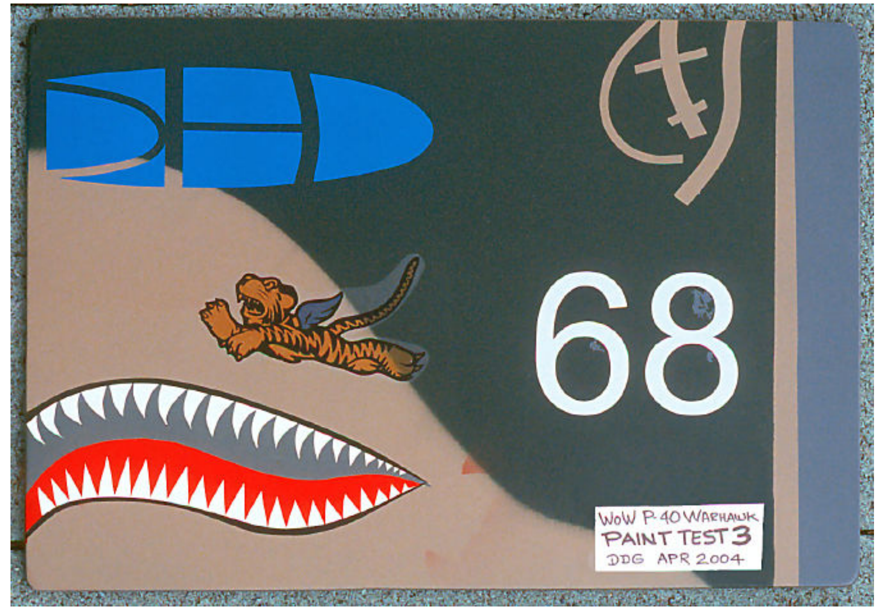
Tamiya TS-29 SEMI GLOSS BLACK for shark mouth

Tamiya TS-26 PURE WHITE for shark mouth, eyes

TAMIYA COLOR SPRAY PAINTS (TS) color chart <www.tamiyausa.com/product/paints/images/ts_color_chart.jpg>

TAMIYA COLOR SPRAY FOR AIRCRAFT (AS) color chart <www.tamiyausa.com/product/paints/images/aircraft_chart.jpg>



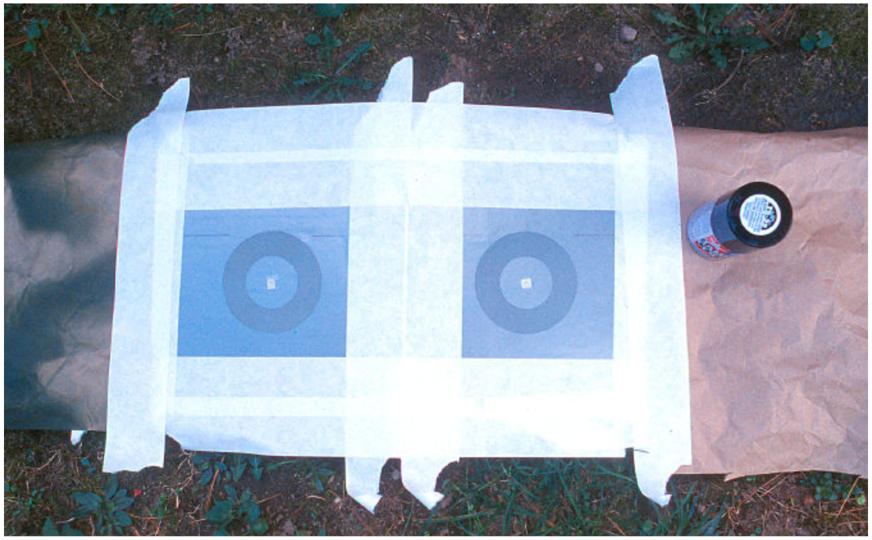


Left: Paint Test 2. Paint compatibility and coverage tests on a piece of 1/4 inch plywood. Dave used these to check spray pattern from the cans, paint coverage and decal coverage. First color sprayed was the Krylon primer, then the Tamiya tan, and finally the Tamiya green. Also, two colors were tested for the "68" and "13" fuselage number markings. These numbers were masked using cut-vinyl lettering from a sign shop. The blue area was masked with tape, and used to assess the canopy paint color choice. Red and gray in the shark's mouth were masked with frisket. On Test 2 Dave experimented with brush (upper teeth) and frisket (lower teeth) for painting the shark's teeth.

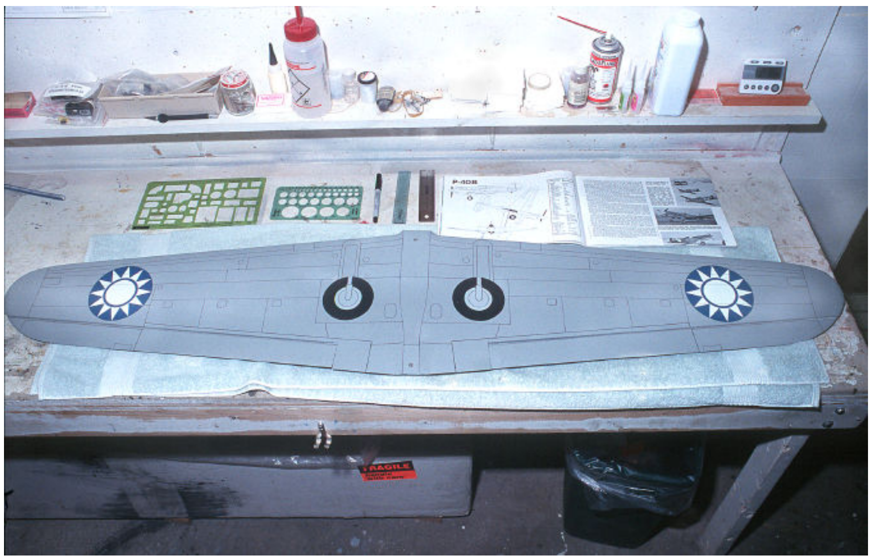
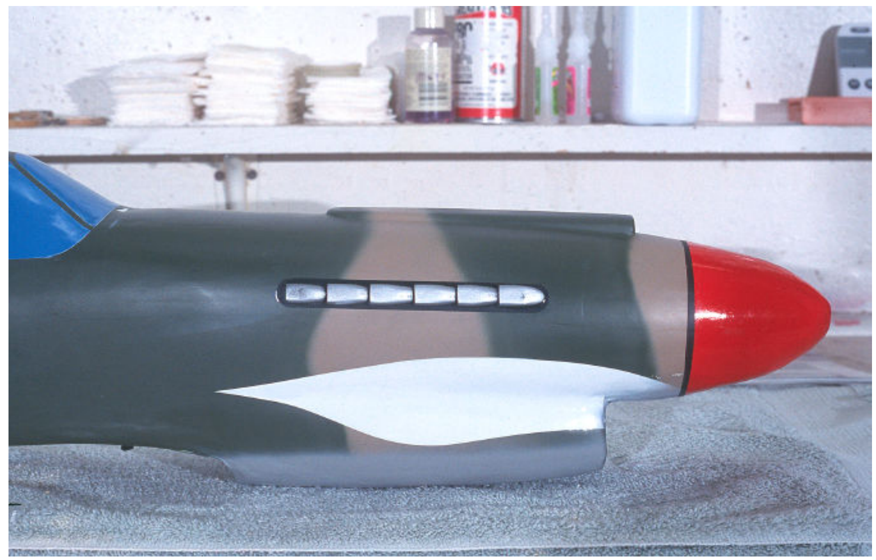
Right: Paint Test 3. More paint compatibility and coverage tests. The squiggles in the upper right are masking tape flexibility and edge coverage tests. Shark's teeth all masked with frisket this time, checking the appearance of curved-line teeth (upper) and straight-line teeth (lower). Black line around shark's mouth also frisket-masked. This test shows decal fade out over the green paint, corrected in the final run by applying a white background to the custom decals. Finally, gray around the "68" numeral shows gray primer where green paint pulled up. The vinyl masks, designed for truck lettering, have aggressive adhesive. The adhesive tack was reduced on the airframe by a very light dusting of talcum powder.

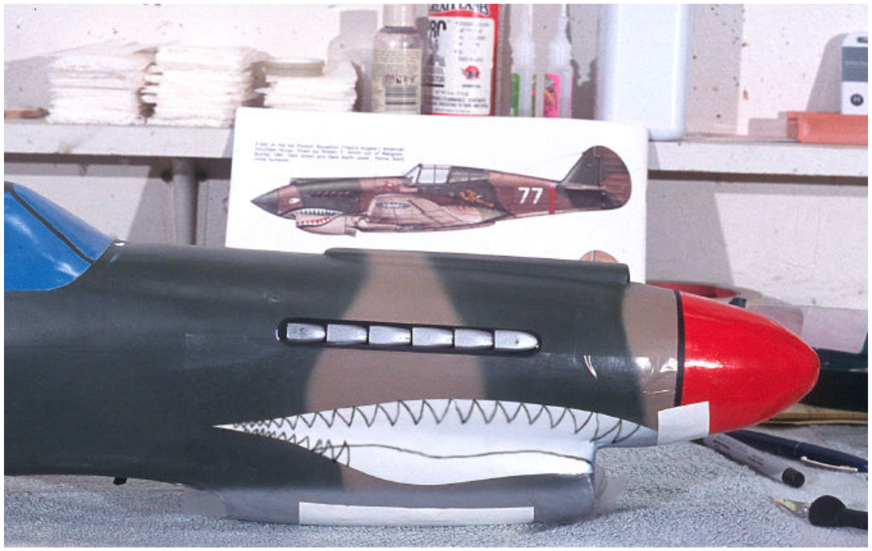
If you're new to frisket, start with a simple project like the tire markings on the underside of the wing. Here Dave lays out the markings with a pencil compass after some of the major panel lines are drawn with Sanford Ultra Fine Sharpie (TM) marker.

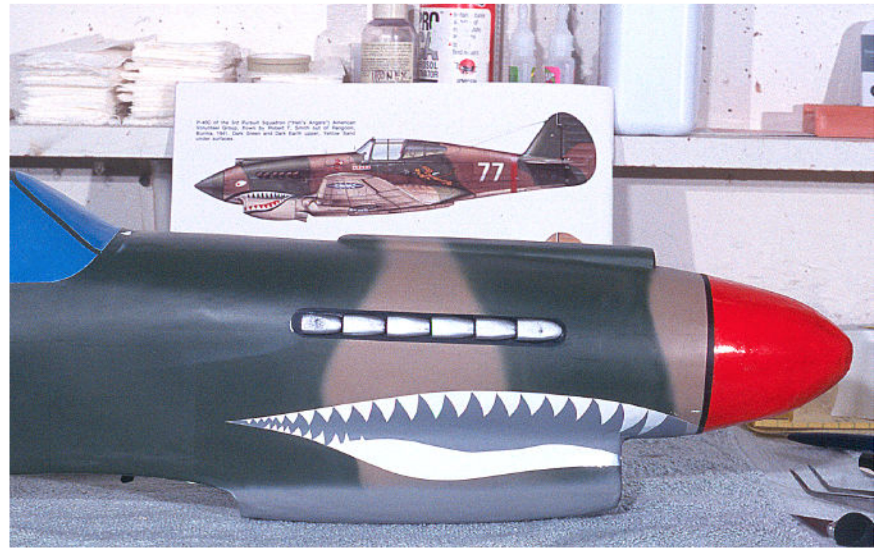
Frisket film is applied to the underside of the wing, and the tire marking areas are cut out with a special compass which holds a blade.



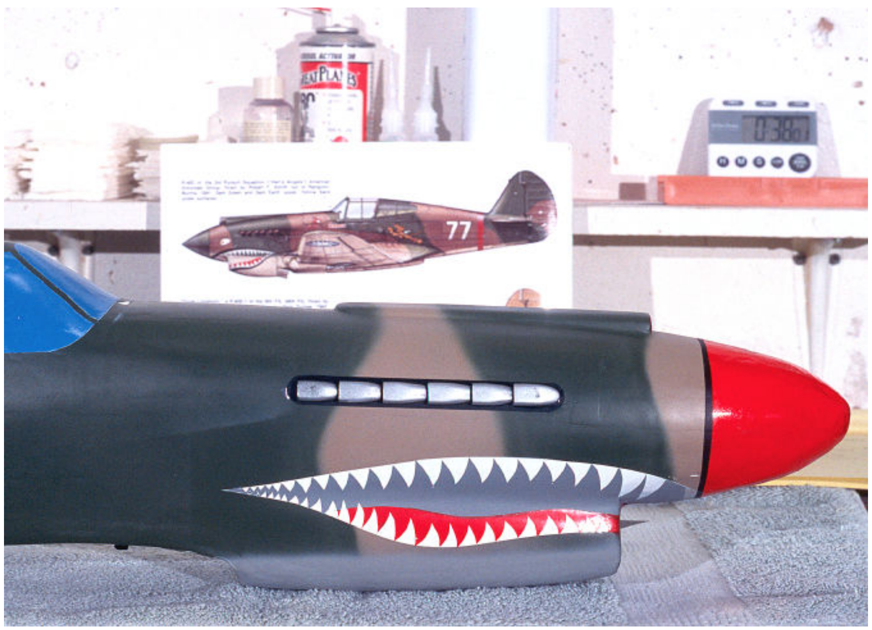
Left: The rest of the wing is masked off, leaving only the tire marking area exposed. Right: Application of semi-gloss black paint directly from the can to make the tire markings. Note the rattle-can application of paint for the tire markings and all painted markings in this article. An airbrush can be used, but is not required.

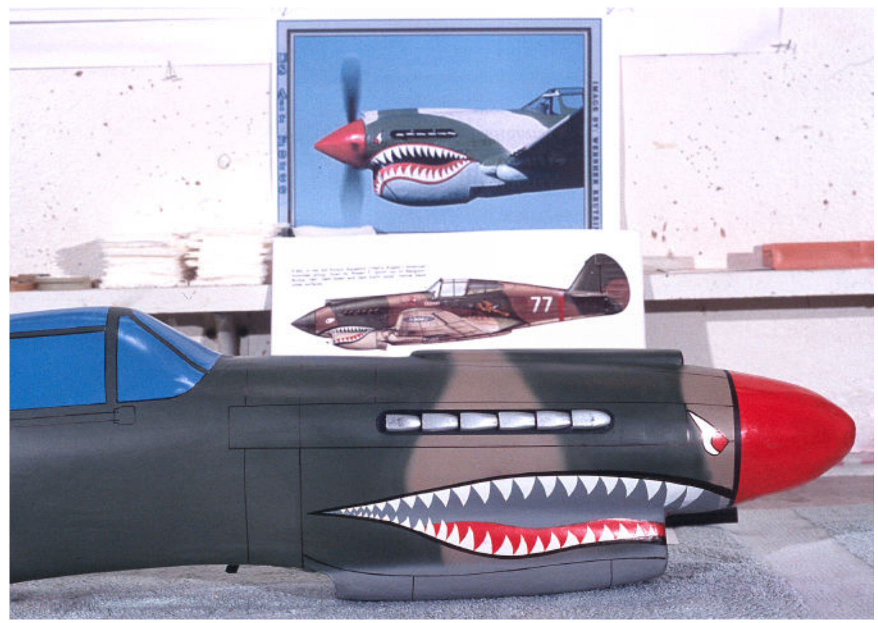


Left: The tire markings look pretty good, along with the completed panel lines and decals. Panel line tools include green plastic templates, Sanford Ultra Fine Sharpie (TM) marker, rulers and the Squadron/Signal "Curtiss P-40 in Action" book with 3-view drawings for reference. Right: Now for a little more involved frisket project, the shark's mouth. After the main camouflage colors are applied, the canopy and spinner painted, Dave first applied the white paint for the teeth, masking with tape.





Left: Frisket applied over white paint after it has dried thoroughly. The Sharpie (TM) marker writes well on the frisket as a cutting guide. Frisket is cut with a hobby knife using a fresh blade. Right: Medium gray paint has been applied and the frisket removed.





Left: Red paint has been applied and the frisket removed. Right: Black has been added around the shark's mouth, here with Sharpie (TM) marker, but it could be painted using frisket mask if you wish. The shark's eye has been added and panel lines completed.

FeatherCut Upgrade

Brent Douglas, <bdouglas@woh.rr.com>

OK, first of all I want to say the FeatherCut is a great hot wire foam cutter, and it's given me many years of use. That being said, I waste a lot of foam and time doing cores. The problem? The cutter doesn't always track true as I cut tapered foam.

The FeatherCut bow rests on a small wheel that pivots much like a grocery cart wheel; when it works, a good idea. When it gets off track, the bow slides diagonally, and this changes the taper ratios (that it does so well).

I had heard of people removing this wheel, and I finally decided to do the same.

In the picture below you can see the main support: a 3/4" dowel suspended parallel to my work surface and at a right angle to the bow. Beneath the support, I marked a center line on my work surface to orient the bow and foam.

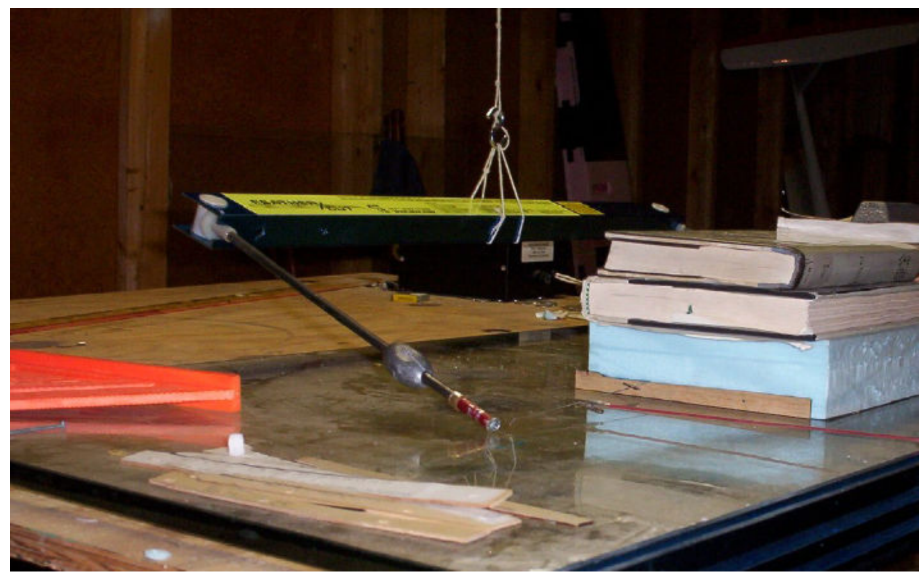
I then hung a length of line from a keychain (the keychain slides more easily on the dowel than the string). I knotted the line once every inch; this allows me to adjust the height at which the bow hangs and allows me to cut taller blocks of foam. With the wheel, I would have had to build up a "track" for the bow.

On my primary bow, I removed the wheel, added a loop of chord, and then connected the bow and hanger with a metal "S" hook. Between the keychain and the way I have my support hung, the bow is free to move forward.

Here's a shot from the side during a cut:

When I use the hanger, I center the foam and the bow under the hanger. Each block of foam I use is marked at mid-width, and I line this up to the centerline I drew on my board earlier.

The end result is a bow that tracks true, even on sharp tapers. It also seems that the bow is less prone to catch on my templates: The whole setup took roughly fifteen minutes, and it's already saved me hours on recuts.

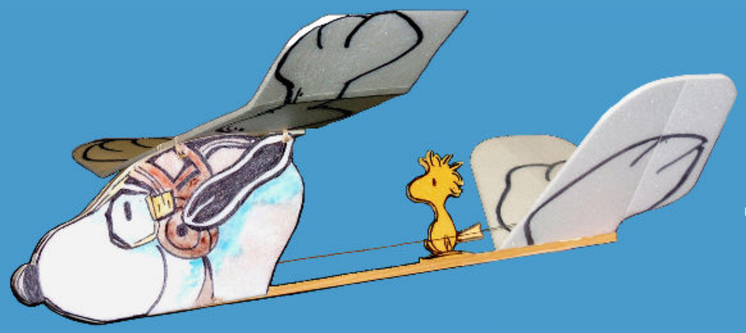


Have Sailplane - Will Travel

...to someplace we never expected

GROOVIN' IN GROVEPORT

by Tom Nagel, <tomnagel@iwaynet.net>



It all started at Don Herbert's pig roast. It was a steamy summer day, and everybody was sweating. Even the pig was a little steamed. Someone had supplied the roast pig with a straw hat and some oversized sunglasses.

One of the guests at the pig roast was Linda Haley, the Community Relations Director for the Village of Groveport, where Don lives. Linda knew that Don was a member of a model sailplane club, the Mid Ohio Soaring Society, and she wanted to get the club interested in doing a museum show of RC sailplanes in Groveport's Town Hall. Don in turn got a couple of drinks into me, and then introduced a new club member Carey Songailo and myself to the lovely Linda. That was the project's wobbly take off.

First thing was I had to find Groveport. I have lived in Central Ohio for 40 years and had never knowingly been in Groveport. Turns out you just bear right at Fred Ricart's car dealership and follow the signs.

Groveport is a small town southeast of Columbus blessed with a newfound flow of (airplane related) cash and progressive and far sighted city leaders. One of the things they did was renovate their original Town Hall into a combination museum and art gallery.

Each month Groveport hosts an art show, painting, sculpture, quilts, Lego Land, Smithsonian traveling exhibits, and for the month of December 2005, RC Sailplanes from the Mid Ohio Soaring Society.

Linda gave us a tour of Groveport Town Hall. The building had been originally constructed in 1876 with funding from the International Order of Odd Fellows. I figured that our sailplane club would fit right in.

The art gallery room had a heavy duty picture molding installed up near the 18 foot ceiling; large mobile glass cases lined the walls, ensuring that visitors to the gallery would not be able to reach up and jiggle the suspended model aircraft. The Village offered to provide a TV and DVD player for model aviation programs, and a computer to run Bill Kuhl's PowerPoint presentation on RC soaring.

The Village said they'd do the press releases, provide security and sponsor an "artists reception" for the opening of the show.

I began to worry about whether I had enough black clothes.

Don, Carey and I began by sending emails to the club membership, seeking commitments for the loan of sufficient models to fill the room. The club members had understandable concerns for the safety of their cherished models, but we got a lot of YES votes, and not a single NO vote.

Don Herbert did all the hard work, collecting commitments for volunteers to bring in planes and get them hung for the show, collecting data for placards for each plane, rounding up airplane hanging supplies and even enlisting his wife Crowbar Betty to do the artwork on the Flying Beagle and also to cater the reception.

This is the main sign for the exhibit, prepared for us by Linda Haley at the Village of Groveport.

Club member Carey Songailo and Steve Krupp's ARF DC-2 next to Steve's ME 109. The Infamous *Flamingoid*, built by Tom Nagel, hangs on the wall next to Steve's scale electric FW 190.

Todd Anderson hangs Hugh Rogers' *Paragon*.

Carey Songailo with the *Drifter II* by the late R.S. Zastrow, Betty and Don Herbert and Tom Reisch in the background. The plane with the unpainted fiberglass fuselage and red rudder is an *Opus* 750 belonging to Todd Anderson.

Betty makes a mean liver pâté, a skill honed by years as a Washington DC hostess. Having conquered Pentagon bureaucracy, learned home remodeling and mastered the culinary arts (three endeavors where use of a crowbar is mandatory) she now threatens to learn how to fly an RC sailplane.

As planning progressed we decided to expand the category of model planes to include some electrics as well, since our club has had a Park and Recreation permit to fly electric powered sailplanes and park fliers at our field for the last few years.

Also, a long time client of mine had found a fully built, never flown sailplane model in his dad's Groveport basement after his father passed away. We added that to the show.

In the spirit of inclusion, Don even invited Groveport resident Bob Queen to show his large gas powered RC helicopter in one of the display cases.

AMA headquarters sent two shipments of literature for a handout table, and Bill Kuhl emailed us his PowerPoint presentation. A local hobby shop loaned Don Herbert some boxes of kits and ARF's to display. I printed out a big stack of *RCSD*'s pamphlet "Getting Started in RC Soaring."

On the morning that we were supposed to hang the show, I drove down to Groveport with a van full of model sailplanes, wondering what I had gotten myself in for.

Soon Town Hall was full of model planes and MOSS volunteers and bemused city employees.

We hung up sailplanes from 118" span down to park flyer made out of a pizza box from Groveport's local pizzeria, Little Italy.

We had NATS awards winning scale electrics, and a pink sailplane with plastic yard flamingo parts.

We had styrofoam, EPP, balsa, obechi, fiberglass, and a Christmas tree in the corner.

We even had some stick and tissue free-flight models.

And here is the moral to the story: The MOSS members who showed up and brought planes and put this show together were not the usual suspects. Our top of the line contest pilots, record holders and NATS champs did not show up. The show was conceived, put together, supplied and hung by the other guys, the fellows who normally are not in charge, the guys who spend most of the time standing in the second row, quietly crashing planes.

Planes were loaned for a month by no less than eleven MOSS club members, plus the estate of one deceased Groveport resident, and one brave RC chopper jockey.

The moral to the story is that if you have any size to your club at all, it is OK to try new things. New people will show up to do the new things. Doing new things in a club allows for the creation of new leadership roles. It might even attract new members, or get your wife to learn to fly.

The gallery looked good, the planes looked good, everything was safe and secure, and that weekend about 750 people came through, all families taking their kids upstairs to the village Christmas celebration.

A week later we did a small class for folks interested in getting started in RC flying. Again, the fellow who organized the program and led the class was not one of the club hotshots, but rather one of the quieter club members, who had done some deep thinking about what it takes to learn to fly RC.

All sorts of un-tapped talent emerged from the ranks of MOSS membership during the course of this project.

The show is closed now. Linda Haley estimates that a couple of thousand people saw it during the month of December.

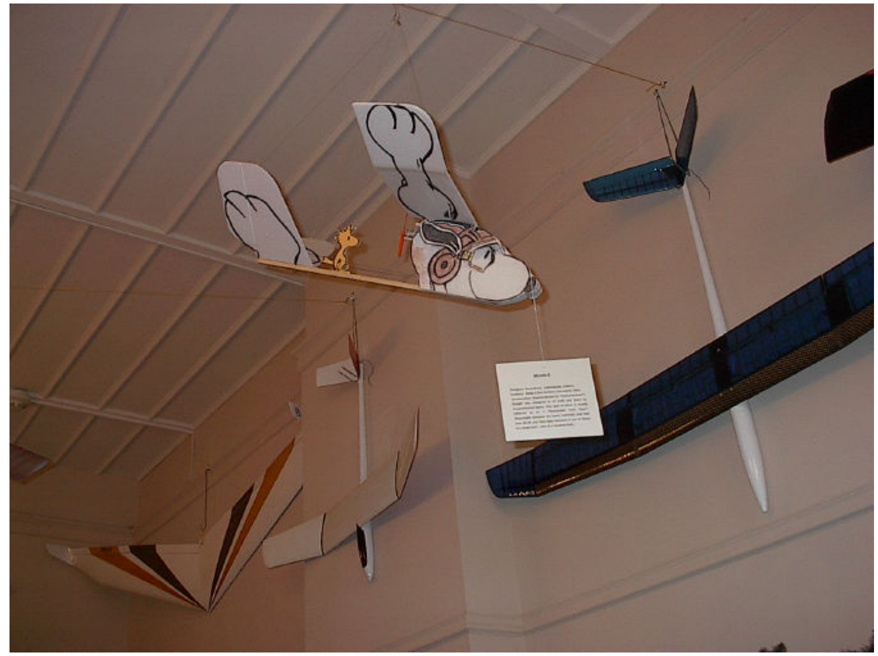
It may be a long time before we ever do anything like it again, but for one month, model sailplanes that would have been otherwise gathering dust in our basements during the early Ohio winter got their chance to shine in an art museum gallery.

No model airplanes were injured in the operation of this exhibit.

Above: Getting everything set up. There's a mini foamy wing and the Beagle (Snoopy) by Don and Betty Herbert, a *Drifter II* by the late R.S. Zastrow, a *Tiger Moth* by Don Herbert, and the Hugh Rogers *Paragon*.

Above right: On the wall is the *Drifter II* by the late R. S. Zastrow and *Miss 2.1* by Tom H. Nagel. In the bookcase is a stick and tissue bare bones model by new member Tom Reisch. The covered stick and tissue model is a WACO cabin biplane by the late Lee McMullin, now owned by Tom Nagel. The bottom shelf holds Don and Betty Herbert's mini foam wing. On the corner wall is a 2M *Little Bird* owned by Dr. Greg Bell, and a *BOT* ARF updated and owned by club president Steve Staley.

Right: Overhead, a Speed 400 *Dalair,* built by former club president and ladder monkey Steve Krupp. Above the cabinet doors, a cardboard flying pizza box park flyer by Don Herbert, the show's honcho. Over the left doorway is Hugh Rogers' *Paragon*. Over the right doorway, *Sparky*, an ARF owned by Carey Songailo. To the far right, over the door, is a Tom Hoopes built 100" *Klingberg Wing*, owned by Tom Nagel.



Upper left: Steve Krupp's ARF DC-2 and Don Herbert's pizza box flyer.

Above: Tom Hoopes built 100" *Klingberg Wing*, owned by Tom Nagel; Todd Andersons *ELI II* HLG, and Todd Anderson's 2M *Organic*.

Left: A senior citizen group hears about RC flying.

A Brief History of the Village of Groveport

The original settlement of what is now the Village of Groveport, Ohio began in the early nineteenth century. Settlers, with little except the determination to found new homes, began to arrive in the vicinity. They came from Pennsylvania, Virginia, Kentucky, Maryland and other states to the South and East. The signing of the Treaty of Greenville in 1795 ended hostilities with Native Americans and gave these hardy pioneers, traveling through the wilderness, a feeling of safety they had not previously enjoyed.

The opening of the Ohio Canal in 1831 was a boon to the settlements along its winding course and warehouses and mills began to spring up along the banks of the canal.

For several years in the 1840's, an argument had smoldered between Jacob B. Wert and William H. Rarey. Wert had laid out a little town plat he called Wert's Grove and Rarey had laid out a similar town plat he called Rarey's Port with only a section line dividing the two settlements.

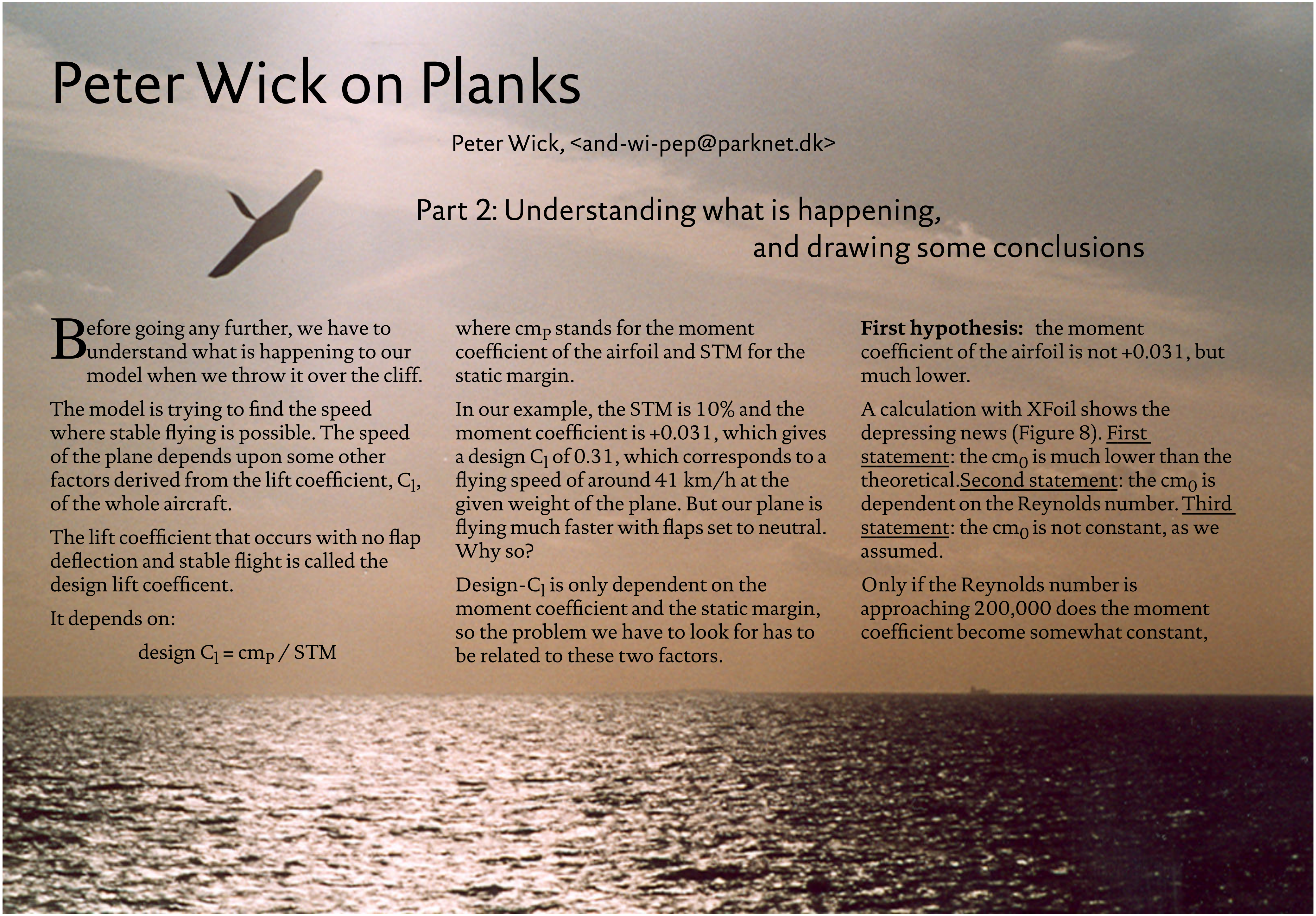
Each of these men was determined that his name should be perpetuated in the naming of the village and it was with pardonable pride that each maintained his stand. In 1812, Rarey's father, Adam, an original settler in the area, had constructed a log tavern on the site where now stands the freshman school.

Wert did hold one advantage, however, as he was postmaster and had been for a period of eleven years or more, operating the post office in a building he constructed on the southwest corner of Main and College Streets. Not to be outdone from this post office angle, Rarey, it is claimed, advised his friends to address their letters to Rarey's Port and many letters were received addressed in this manner. Wert, equal to the occasion, simply scratched out the address and wrote in Wert's Grove eliminating as best he could the result of Rarey's scheming.

Finally Dr. Abel Clark suggested the name of Groveport, the derivation of which is readily apparent. Such a name, Clark pointed out, did no injustice to either Wert or Rarey. The name was readily adopted and in April of 1847, the Village of Groveport was incorporated. (It is just good luck that the founding fathers of the new town were not named Herbert Arm and Stanley Pitt.)

In the next century growth in the village was not entirely residential. The federal government ceded Rickenbacker Air Force Base to the City of Columbus in the 1980's; the plan was to develop it as an air freight hub. Groveport officials astutely annexed all the township land right up to the front door of Rickenbacker Port Authority. Businesses, such as Radio Shack, K-Mart, GAP, and Distribution Fulfillment Services (Spiegel/Eddie Bauer) moved in provide jobs and a tax base for the village. Accordingly, it is perhaps not so strange that Groveport decided to do a museum show celebrating the beauty of flight. After all, that is where all they city money comes from!

(Excerpted from The Changing Village: A History of Groveport, Ohio 1847-1997 *by Richard Lee Palsgrove.)*



Peter Wick on Planks

Peter Wick, <and-wi-pep@parknet.dk>

Part 2: Understanding what is happening, and drawing some conclusions

Before going any further, we have to understand what is happening to our model when we throw it over the cliff.

The model is trying to find the speed where stable flying is possible. The speed of the plane depends upon some other factors derived from the lift coefficient, C_l, of the whole aircraft.

The lift coefficient that occurs with no flap deflection and stable flight is called the design lift coefficent.

It depends on:

$$\text{design } C_l = cm_P / STM$$

where cm_P stands for the moment coefficient of the airfoil and STM for the static margin.

In our example, the STM is 10% and the moment coefficient is +0.031, which gives a design C_l of 0.31, which corresponds to a flying speed of around 41 km/h at the given weight of the plane. But our plane is flying much faster with flaps set to neutral. Why so?

Design-C_l is only dependent on the moment coefficient and the static margin, so the problem we have to look for has to be related to these two factors.

First hypothesis: the moment coefficient of the airfoil is not +0.031, but much lower.

A calculation with XFoil shows the depressing news (Figure 8). First statement: the cm_0 is much lower than the theoretical. Second statement: the cm_0 is dependent on the Reynolds number. Third statement: the cm_0 is not constant, as we assumed.

Only if the Reynolds number is approaching 200,000 does the moment coefficient become somewhat constant, but it never reaches the theoretical amount - it is always lower.

According to some wind tunnel measurements (Hepperle, 1996) (Figure 9), the cm_0 of the Eppler E184 at a Reynolds number of 100,000 is approximately –0.025, which is close to the Xfoil result!

Our plank which we threw over the cliff is unstable because the moment coefficient is negative. But by using some up elevator trim we can change that situation. By trimming in this manner, the center of pressure comes closer to the CG and guarantees stability.

The reason why the E 184 does not reach the theoretical amount of positive moment coefficient is that the laminar separation bubble is, so to speak, changing the geometrical form into another form.

Not only is the shape of the polar (the drag and lift of the airfoil) changed, but also the moment coefficient. That's why the pitching moment is dependent on the Reynolds number and is not constant at different angles of attack.

Second hypothesis: the fuselage is affecting the Cm.

Another factor which is changing the moment coefficient of our airplane is the fuselage. In most cases the fuselage contributes with a negative moment and moves the neutral point.

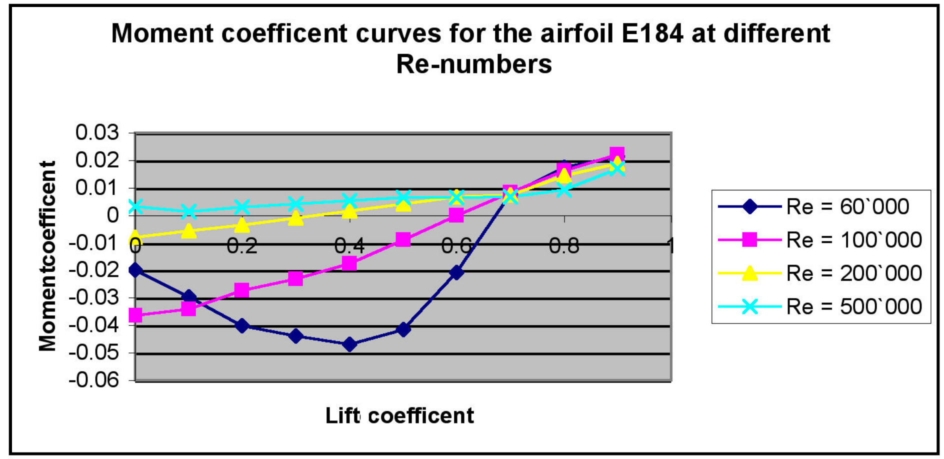


Figure 8

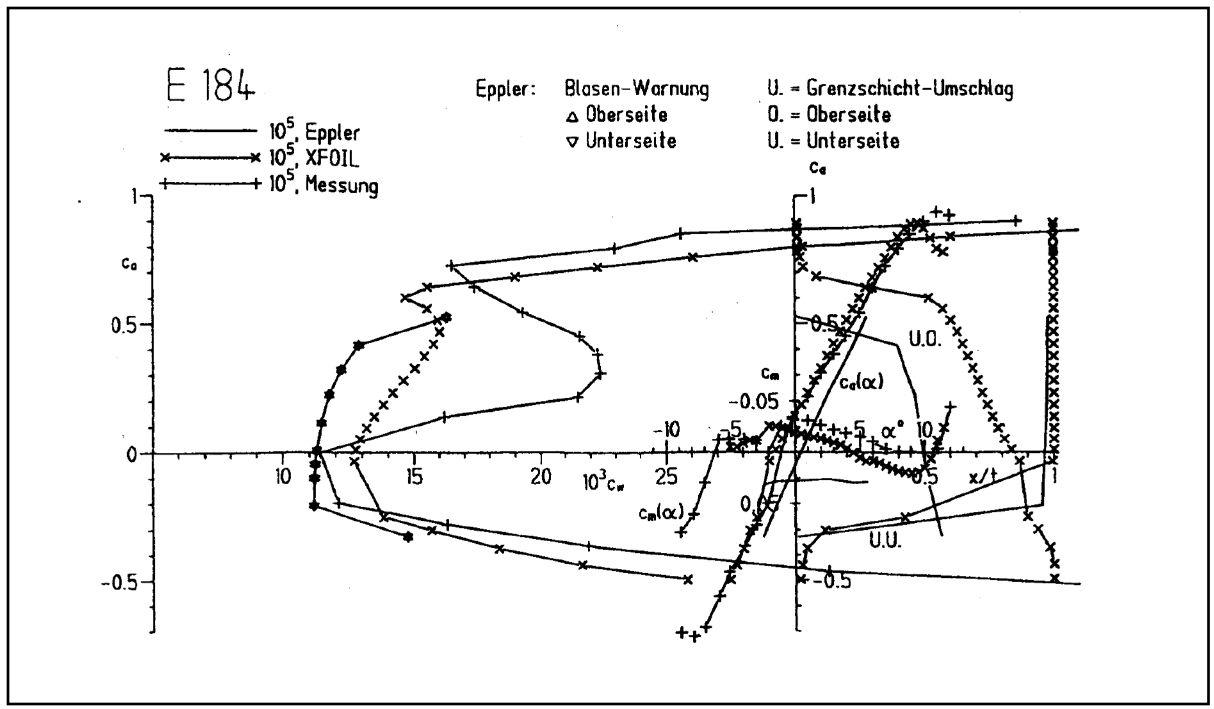


Figure 9

Why are these thing so catastrophic for the performance of our plank? The reason is that we have only two possibilities to fly slower.

Remember the formula:

$$\text{design } C_l = cm_P / STM$$

So, the possibilities are: a more positive moment coefficient of the airfoil, or a smaller STM.

The moment of the airfoil gets more positive by deflecting the flaps upwards, but by doing so we actually decamber the airfoil and reduce the maximum possible amount of lift available.

The other possibility is to reduce the static margin. This is possible, but only to a certain amount. Otherwise, if the CG comes very close to the neutral point, the plane is showing some kind of "rodeo-ride" and will not be readily controllable. But more to this subject later.

Actually, you can say that fuselages on flying wings are reducing the maximum lift of the airplane and adding drag. So flying wings should be flying wings.

Another conclusion is that the flying plank concept is not very suitable for flying thermals. A statement which is a little bit provocative provides the reasons for this notion:

To fly in thermals, especially in very tight circles, you need an airfoil with a high maximum lift coefficient, because every type of plane can be built light.

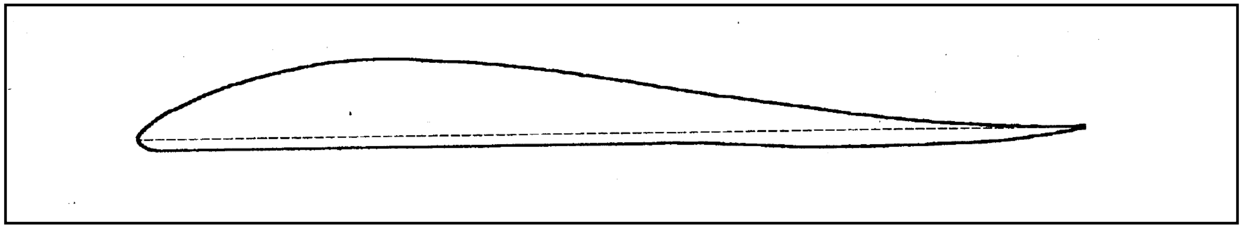


Figure 10. CJ-3309

For a very slow flying plank you need an airfoil with a lot of camber and with a big positive moment coefficient. This necessary S-shape, or the upwards deflected flap, reduces the maximum lift available and normally leads to an airfoil which is prone to have some problems with laminar separation.

If you use airfoils with turbulators or with a very early transition from laminar to turbulent, you pay in drag.

A number of airfoil databases have archived, and several airfoil plotting programs therefore utilize, an incorrect coordinate table for the CJ-3309. The lower surface from the tangent of the leading edge radius is not a *flat* line, as depicted within this article series, but is rather a *straight* line back to the 70% chord position, as shown by the red line in the illustration above.

The CJ-3309 aerodynamic data in this series of articles was derived from an incorrect coordinate table. Readers should keep in mind that this article series is therefore internally consistent, but may be at variance with outside references.

You may argue that planks normally use quite a large wing chord and therefore are flying with higher Reynolds numbers and therefore do not have troubles with laminar separation.

Yes, but by doing so, you are reducing the aspect ratio and actually flying that kind of task where it is most relevant, slow in thermals, so you pay again in drag, this time in induced drag.

Furthermore, airfoils with a lot of camber and a lot of S-shape (the CJ3309, for example. See Figure 10.) react badly to flap deflections, specifically on positive flap deflection for flying faster.

In this configuration you actually have taken a highly cambered airfoil (3.34%) and made it an even higher cambered airfoil. When trying to fly fast from one thermal to another, or just trying to flee from sink, you will be caught.

Now it would help if your ship is very heavy, but wasn't that the reason to build a very light thermal plank?

Sure planks can fly thermals, but my statement is, there are much better concepts. The main task for planks is fast flying on the slopes.

So how do we make a good flying slope plank?

That's in Part 3!

NASA RESTRUCTURES AERONAUTICS RESEARCH

In a move designed to better align the agency's aeronautics research, Lisa Porter, NASA's associate administrator of the Aeronautics Research Mission Directorate, announced a comprehensive restructuring of research programs.

"NASA is returning to long-term investment in cutting-edge fundamental research in traditional aeronautics disciplines," Porter said. "We are investing in research for the long-term in areas that are appropriate to NASA's unique capabilities and meeting our charter of addressing national needs and benefiting the public good."

The new programs include fundamental aeronautics, airspace systems, aviation safety, and the aeronautics test program.

The goal of the fundamental aeronautics program is the development of system-level, multi-disciplinary capabilities for both civilian and military applications. This program provides long-term investment in research to support and sustain expert competency in critical core areas of aeronautics technology. The work in fundamental aeronautics will produce knowledge, data, capabilities, and design tools to benefit a variety of air vehicles.

The research focus of the aviation safety program is on the way vehicles are designed, built, operated, and maintained. Scientists and engineers in this program will develop principles, guidelines, concepts, tools, methods, and technologies to address four areas: aircraft aging and durability, integrated intelligent flight deck technologies, integrated vehicle health management, and integrated resilient aircraft control.

The aeronautics test program will ensure NASA wind tunnels and air-breathing propulsion test facilities are available to meet research requirements and those of other national partners. The program will make decisions regarding the strategic use, operations, maintenance, and investment for facilities at NASA's Ames Research Center, Moffett Field, California; Glenn Research Center, Cleveland, Ohio; and Langley Research Center, Hampton, Virginia.

Excerpted from NASA NEWS. For more information about the Aeronautics Research Mission Directorate, visit: <http://www.aerospace.nasa.gov >.

Live Hinge Spoiler Installation in an Organic RES Model

by Lee Murray, <lmurray@athenet.net>

The *Organic* 2.5M RES and *Soprano* RES models come with a live hinge. If you are not familiar with the term "live hinge," I am talking about an embedded hinge made with carbon fiber and Kevlar which is integral to the wing surface.

While the hinge is indestructible and will never become misaligned, it presents a challenge to close the spoiler with a small servo. The spoiler in a natural position seems to rise about 30 degrees up off the closed angle.

Using loose weights I determined that the spoiler can be held closed by 120 grams of force (4 oz.). Because I had never had to deal with this situation before, I felt the need to do an analysis of the various options for keeping the spoiler closed.

Closing the spoiler using a piano wire torsion spring has been my favorite approach for more than for 20 years. One end of the spoiler blade contains a small square brass tube which carries the bent end of a thin wire, e.g. 1/32", and the other end of the wire is attached to the wing. A quarter twist in the wire provides a tensional force to close the typical spoiler and a force which can easily be overcome with the spoiler servo.

For the *Organic* live hinge, the hefty torsion spring would have to apply 4+ oz. of closing force which would have to be overcome by the servo. As the spoiler blade rose and the torsion spring twisted even more, the servo load would increase. I would guess the load on the servo could easily rise to 8 oz. plus any aerodynamic loads.

Perhaps rubber bands might be used so that the mechanical advantage of the rubber band would decrease as the spoiler blade came up to vertical but that didn't seem like a good plan. We all know that rubber bands become brittle and break at some inopportune time as per Murphy's rule.

Obviously the manufacturer planned for servos to be used to drive the spoiler bladed with the load going one way when closing and the opposite when fully opening the spoiler. The down side here is that the two servos would be driving the blade closed during almost all of every flight, which would drain the flight battery too fast. This doesn't include the potential damage the small servo under continuous load.

On the positive side using a separate servo for each spoiler makes the installation and adjustments easy. One can use the transmitter settings and trims to adjust end points and travel. The challenge for me was to create a system where the servos had no forces on them in the closed position and have them open to 90 degrees if I wished.

Hitec HS50 micro servos were purchased for the spoiler operation because they were light and inexpensive. The installation set up was not straight forward and there were neither instructions nor diagrams. Decisions needed to be made.

Which way should the servo be set into the cavity?

Should the arm point forward or backward?

Where do I attach the connecting rod to the spoiler blade?

One couldn't say for sure without some planning if the setup will achieve the goals.

I decided to use a graphic analysis on chart paper. Figure 1 illustrates my analysis. The reference line runs from the hinge point of the spoiler to the shaft on the servo.

What I learned was that I needed to put the fulcrum, or point of attachment, on the blade 10 mm from the hinge. The rod connection between the servo arm and the spoiler blade should be 15 mm long and look like an L. The short arm of the L goes into the point of attachment on the spoiler.

The servo was fitted with an adjustable fitting so the system could be mechanically adjusted to get things close and the fine adjustments could be made with the transmitter. The servo bay is just big enough for a micro servo with hardware on the servo arm.

Geometry shows that the spoiler can be raised with the maximum mechanical advantage of the servo arm taking place when the spoiler blade is approaching a vertical position where the load would be highest on the system.

I decided to use magnetic force to keep the spoiler closed. Unlike a spring or rubber band, the magnetic force becomes strong very quickly as it approaches another magnet or steel plate.

I had a couple of 7/16" diameter rare earth magnet someone gave me. These were so strong that it is a challenge to take them off a steel plate. As you will see later it takes one pound of force to take them off the steel plate I was thinking of using.

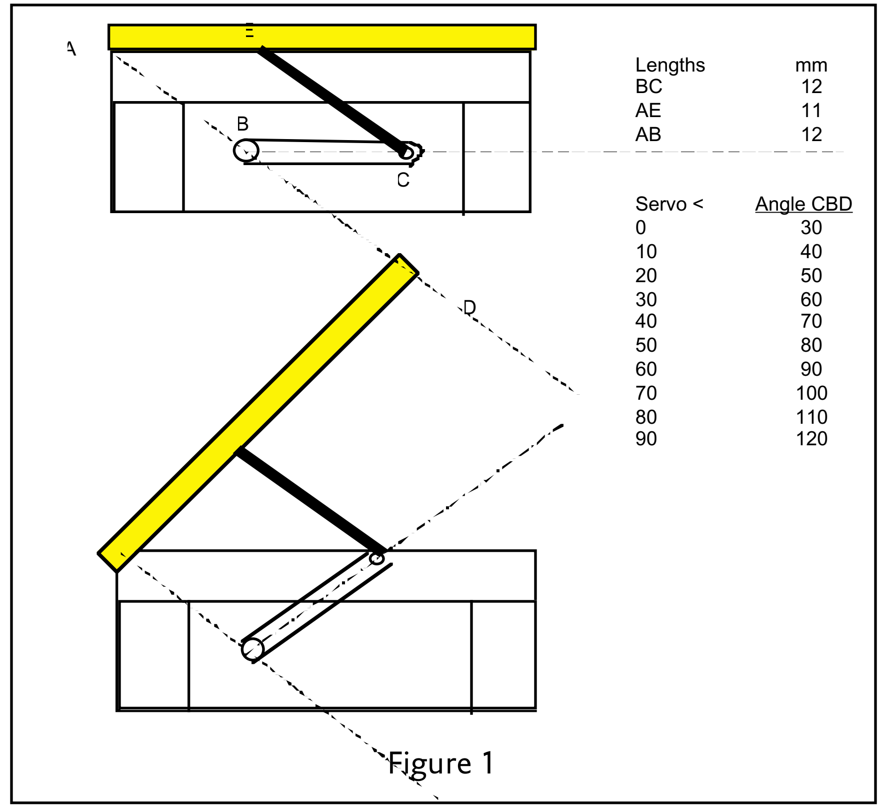


Figure 1

This seemed like overkill so I looked for a smaller magnet at Radio Shack. The smallest I found come as pairs labeled as 3/16" diameter by 1/8" thick round Rare Earth (Neodymium-Iron-Boron) Magnet (Radio Shack #64-1895).

The intensity of the magnetic field is given on the package as 10,800 Gauss. I don't speak magnetism but I can tell you that it is an amazingly strong magnet that weighs 0.224 grams (0.009 oz.).

Because I work with a tensile tester, I could easily measure the forces. I mounted the magnets in balsa blocks or directly in plywood with 1/16" plywood tabs to be grabbed by the grips of my testing machine (see Figure 2). I modified that gripping plan when the plywood was crushed by the grips on the tester. Tape was attached to the plywood and the tape was gripped by the tensile tester. That was a better plan since the magnet being tested could adjust itself to the opposing magnet or plate.

Table I shows the table of measurements of the maximum force and also the force decay curve.

Notes on testing:

• The steel plate seems to have become slightly magnetic and the small magnet would develop a different maximum force depending on where it landed. The initial part of the force curve is due to the tensioning of the test equipment, the true starting point of separation begins at the maximum force.

• As shown in Figure 3, the strength of the attraction falls off at what looks like the inverse square of the distance between the magnet and the plate. In the actual application of closing the spoiler the magnets could be set in such a way that they would not get closer than 0.06" or 60 mils from the steel plate that you see tested above. In that way the spoilers only need to apply a slight force to lift the spoiler off the closed position.

Figure 2. Test Pieces

		Maximum Force (lbs.)	Maximum Force (oz.)	Maximum Force (grams)
Large Magnet on Steel Plate	1	1.01	16.1	457
Small Magnet on Steel Plate	2	0.62	9.9	281
Small Magnet on Steel Plate	2'	0.72	11.6	329
Large Magnet on Small Magnet	3	0.45	7.2	206
Small Magnet on Small Magnet	4	0.88	14	398
Small Magnet on Small Magnet	4'	0.88	14.1	399

Table I. Maximum Forces to Remove Magnets

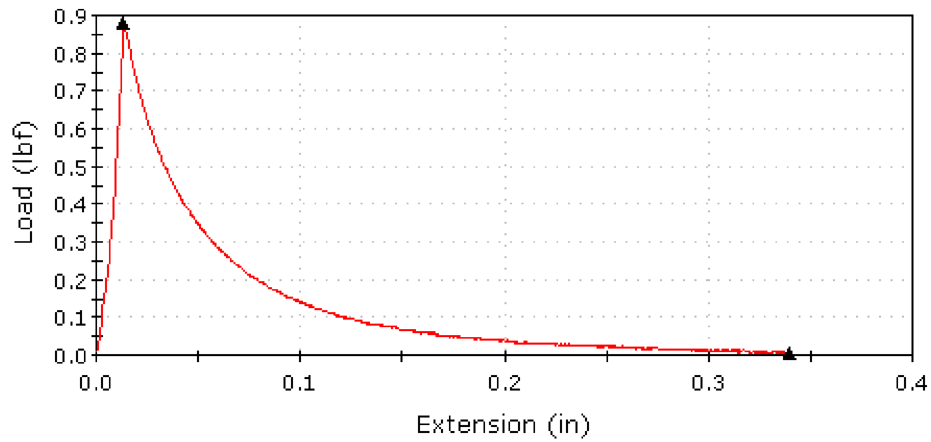
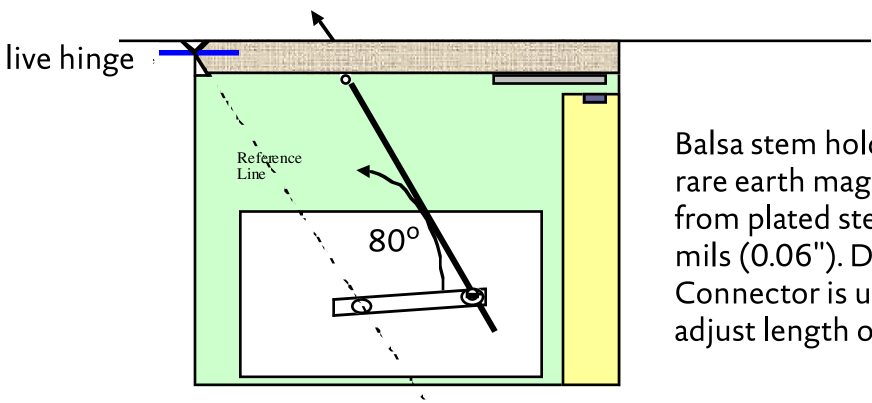


Figure 3. Magnetic Force Curve for Small Magnet on Steel Plate

The fulcrum on the spoiler blade is a 1/16" ID square brass tube. The wire is 1/16" wire.



Balsa stem holding 3/16" diameter rare earth magnet. Magnet is separated from plated steel place by about 60 mils (0.06"). Du-Bro Mini E/Z Connector is used on the servo arm to adjust length of connecting arm

Figure 4. Diagram of installation

Added benefits of the magnetic method of closure:

- The spoiler can be heard to close with a clunk as it gets pulled down by magnetic force. The servos can be trimmed to have zero load when closed.
- The height of opening can be adjusted by the travel adjustment on the transmitter.
- Since this is an RES model, flap control on the Stylus transmitter permits separate left and right adjustment for the two spoiler servos.
- Flap to Elevator compensation can be used to correct for the pitching down attitude of the model when the spoilers are raised.

(Ever notice how many RC pilots mistake spoiler effectiveness with the pitching down attitude that takes place without compensation.)

I want to give credit to Bob Johnson for sharing his experience in installing the radio in his *Organic* RES.

Wind energy extraction for sailplane models

Matthieu Scherrer, <matthieu.scherrer@free.fr>

It has been a long time since I wanted to understand how one can get so much energy in model DSing. Here is the summary of my thinking and reading on the subject, applied specifically to sailplane models.

1. A DS experiment

I did experience one specific situation that makes me think the classical wind strength shear explanation was not the only mechanism in DS. Here is the story.

I fancy starting DS with low energy: the acceleration is even more aggressive and impressive, since you start with little speed. I once started this way the first DS cycle and while crossing the shear layer the glider was really shaken (too slow!) and it just stopped.

So I was on the backside, under the shear region, without energy. I thought "Uh-oh, this time this is the end."

But no! While going quite far and low backside, the glider entered an area where it was as if rockets were firing up. The acceleration was really great, and I got so much energy in just one quarter of a cycle that I was able to reach the shear region again, and to be back on the front side of the mountain.

This may have been a lucky scenario, but something happened here that rang a bell within me about the DS mechanism. Something was to be understood about this…

2. Wind strength gradient theory

Here is the classical explanation you often find about DSing. We often hear something that sounds like this statement:

"As you encounter a gust, the airspeed increase gives you some energy."

A typical DS situation when you encounter a gust is while crossing the shear layer behind a mountain.

This is more or less linked to the following understanding of the mountain airflow (See Figure 1):

Each time you cross the shear layer, from windy front-side to still backside, as well as from still backside to windy front-side, you have a gust. The value strength of this gust is the wind force.

Some basic analysis shows that the energy gain is proportional to the mass of the sailplane and the gust squared:

$$\Delta E = k \cdot m \cdot gust^2$$

I am sure this mechanism explains part of the energy we get while DSing, but it explains only partly why we can accelerate so fast. It does not explain at all how I could get out of the backside as detailed in my DS experiment.

3. Wind direction and inertial speed direction combination theory

Principle

The principle is explained as follows:

"Any wing component perpendicular to the inertial speed will create an apparent thrust created by the so tilted aerodynamic lift, that gives energy to the glider."

Then energy comes from the different orientation between inertial (ground) speed and airspeed seen by the glider. (See Figure 2.)

Indeed, aerodynamic lift is perpendicular to the airspeed, whereas energy stuff is

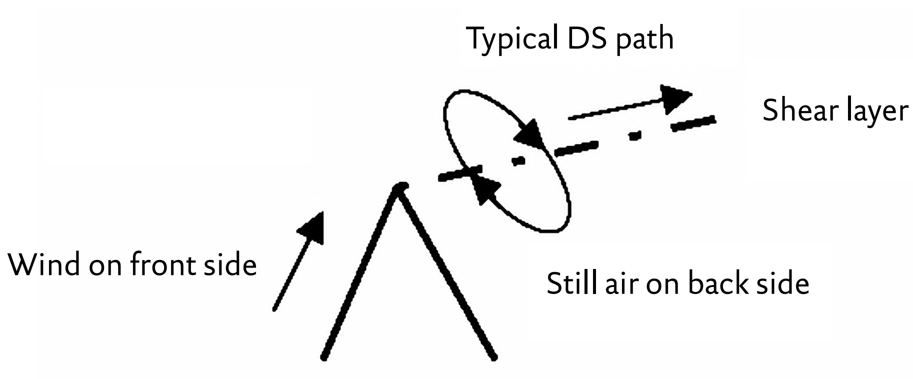


Figure 1

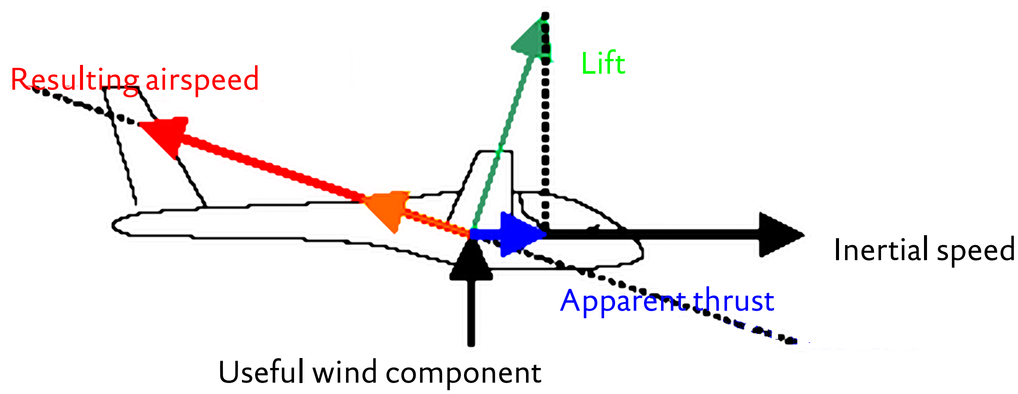


Figure 2

linked to the inertial speed.The tilt created by the wind component creates a thrust component on the inertial speed axis, that is on the trajectory.

Another point is: the higher the lift, the higher the thrust. That is the higher the G-load the higher the thrust.

Strategy to get energy from the wind

To put it in a nutshell, to get maximum energy from the wind, as Lissaman said [3], you have to fly the glider "belly to the wind."

Now we have to find any strategy to get that useful wind component coming to the belly, during a sufficient period of time.

4. Interpreting the classical climbing (thermal and slope soaring)

Basic principle

The first solution to have such a "belly to the wind" situation is to perform a level or slightly banked turn, while staying in an area where a vertical wind exists. This is the classical way to climb in thermal or above slopes.

While flying within the up-rising air region, you have the wind coming up to the belly. (See Figure 3A and 3B.)

Variant: dolphin flying

An idea developed in order to maximize energy transfer is the so called "Dolphin flight." By pulling up

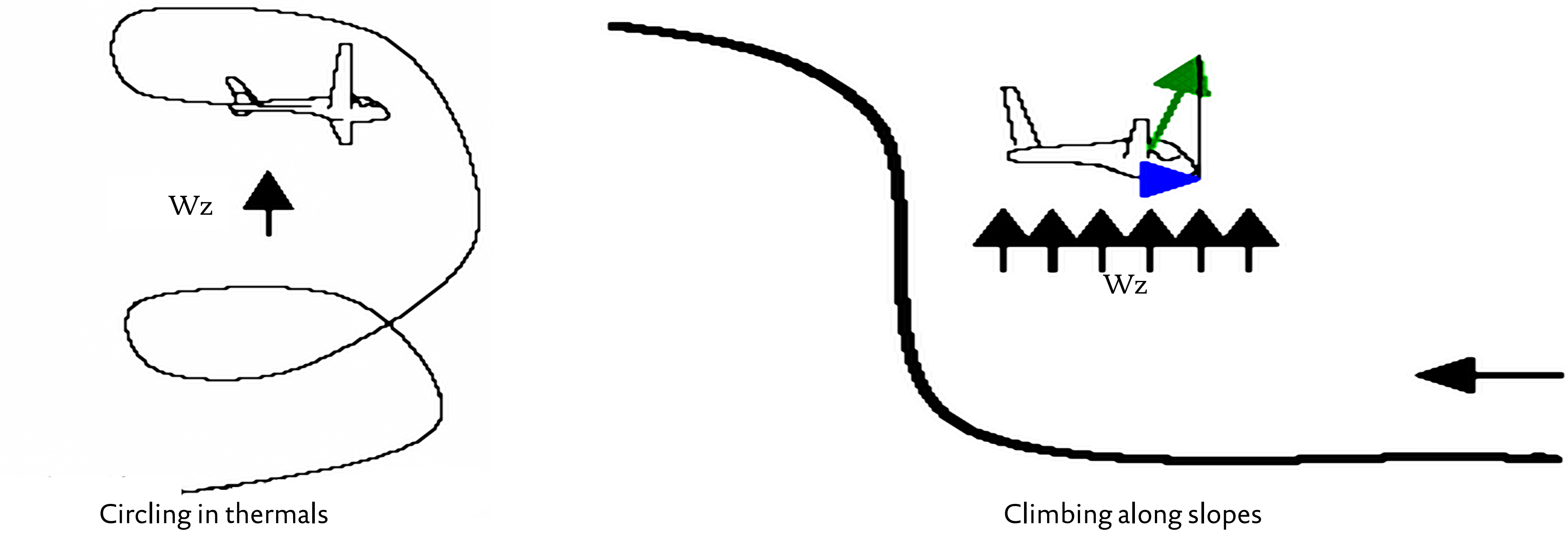


Figure 3A and 3B.

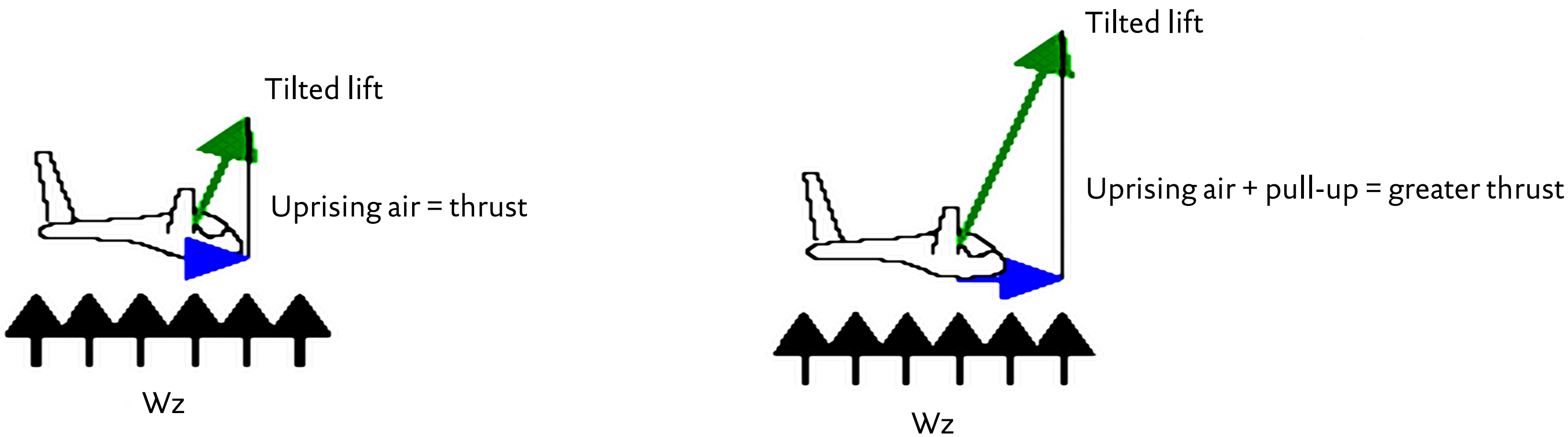


Figure 4A and 4B.

firmly, you increase the lift for a short period of time, that is you increase the thrust force created by the tilted lift into the up rising air. (Figure 4A and 4B.)

The trouble is you can not stay a long time under G-Load in dolphin flight (unless you make a full loop. . ..), so that the period of time you maximize energy transfer is very short.

It is not clear how to decide whether the gain over the short period of time is really worth the maneuver. In fact, drag also increases during pull up. Also, performing the manoeuvre too late or too soon may do more harm. . .

Anyway, the pull up slows the glider down, so after that spend more time within rising air. . .

Anyway, the pull up slows the glider down. This way, the glider spends more time within rising air, which is beneficial to the net height gain, rather than if it had flown across quickly.

5. DS Analysis

DS is also a situation where you are taking benefit of the orientation of the wind, trying to fly "belly to the wind" in the wake of an obstacle such as a mountain.

The ideal DS situation

An ideal situation would be the following: at any position over the trajectory, the wind is so oriented that you have only a "wind to the belly" component.

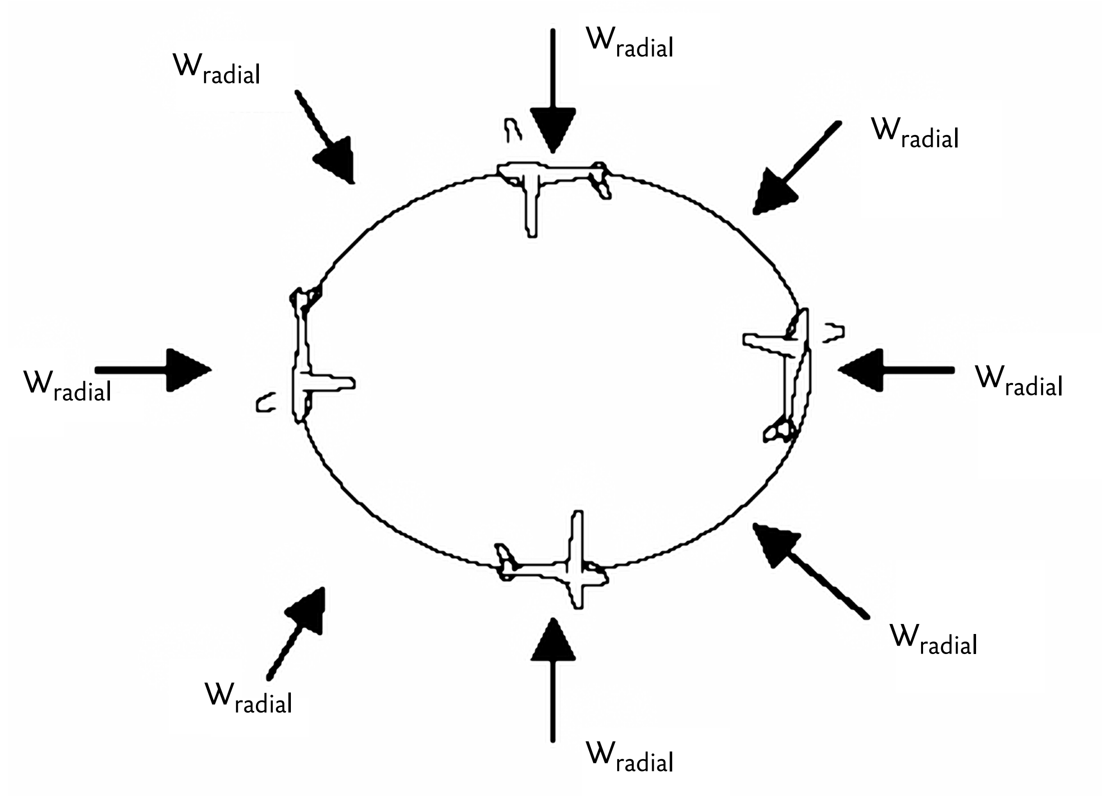


Figure 5.

That is at any station of the trajectory, you have a thrust component due to lift tilt, and the sailplane keeps accelerating.

A very simple solution to get this is to find a radial wind pattern, such as that shown in Figure 5.

The only trouble is: have you ever seen such a wind pattern in real life? If you find it, tell me!

So, we shall stop dreaming and go to a more realistic situation. ;-)

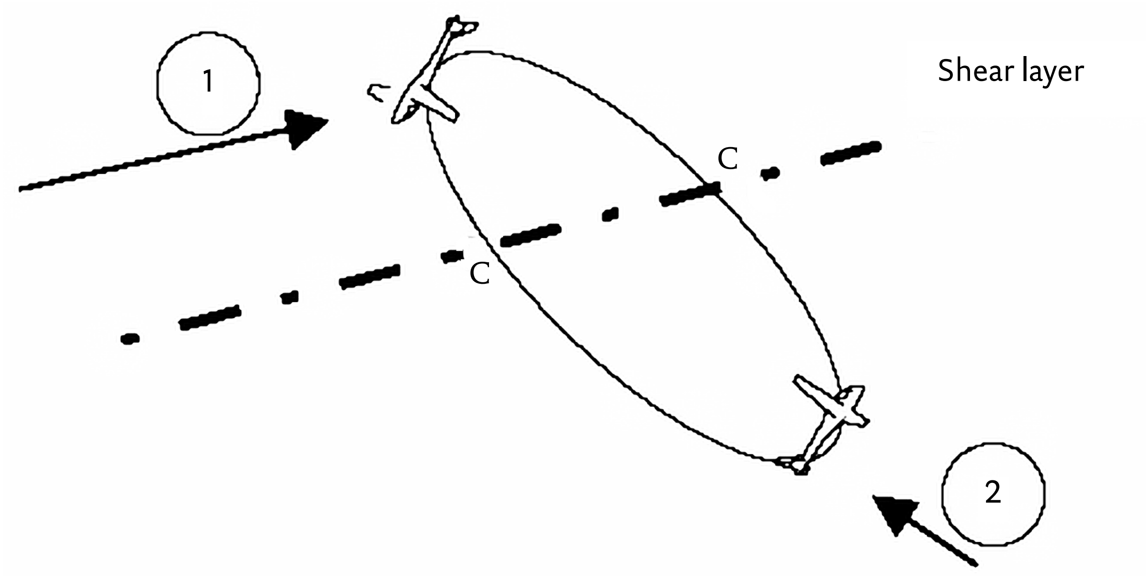


Figure 6.

More realistic situation

Figure 6 is a sketch of a more realistic situation.

Instead of speeding up all around the cycle, just as in our unrealistic example, we have two main zones where the glider is extracting energy from atmosphere.

- In Region 1 (front side), you have a force of great strength, but it's not so well oriented. The "belly component" has a great effect on the energy transfer mainly due to the wind strength value.

- In Region 2 (backside), it is possible, under certain conditions, to find a zone were the wind comes backward: this wind component, even if smaller in strength than on the front side, is very well oriented. That is, the energy transfer you can take from this region may be great.

- In between, as you cross the shear layer in "C" points, you once again transfer some energy trough the gust effect. This is were you got a mere dynamic effect (dependent on the strength of the shear gradient).

I am sure what I did experience was linked to the Region 2 specificity: I reached a region far on the backside where the wind was so oriented that the energy transfer was huge.

Time dependency of DS power

Front side (Region 1) is more or less independent from wind strength. It should always have more or less the same pattern on this side.

On the contrary, on the backside, separated flow pattern behind an obstacle such as a mountain is very sensitive to many parameters. It should certainly have a Reynolds number based on a typical dimension of the slope, that allows defining different regimes.

It means the exact pattern behind is likely to move a lot with time, depending on the actual wind strength, orientation, and temperature…

It could well explain why the energy transfer experienced over a DS session is not steady in time. For some minutes every trajectory seems to firing up a rocket, whereas some minutes later you circle quickly but smoothly.

It could well be linked to the fact that with very little wind strength difference, Region 2 could radically change.

Landscape dependency

In the detail, the flight-path that maximizes the energy gain will be very dependent of the exact flow pattern in the mountain wake. The next step, for increased performance, would be to know exactly the wind pattern behind a mountain, to locate the area where we should turn.

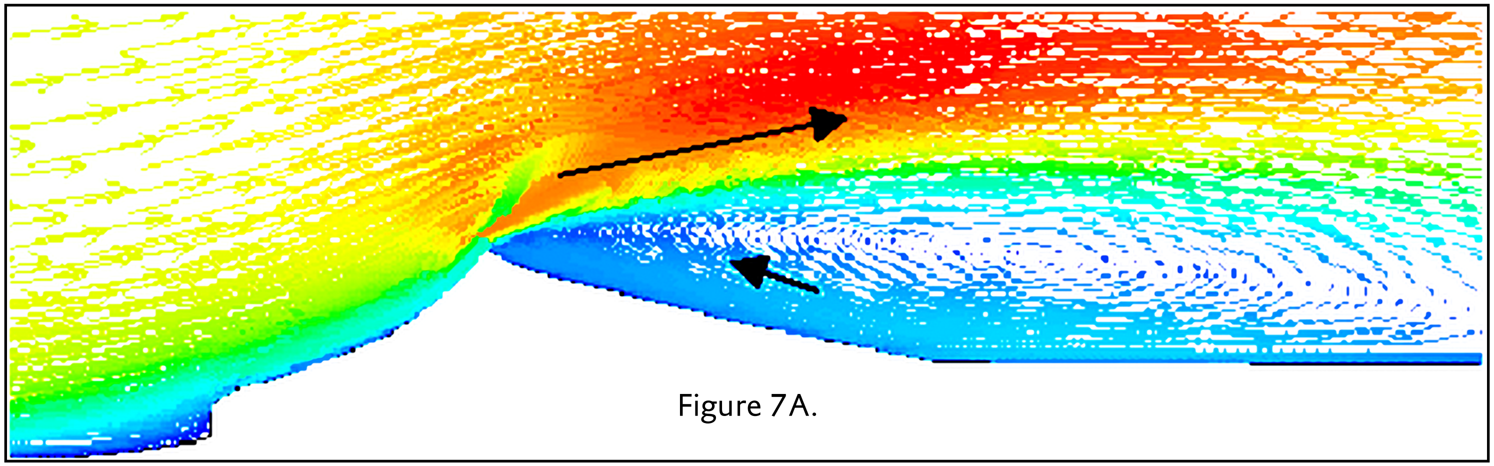


Figure 7A.

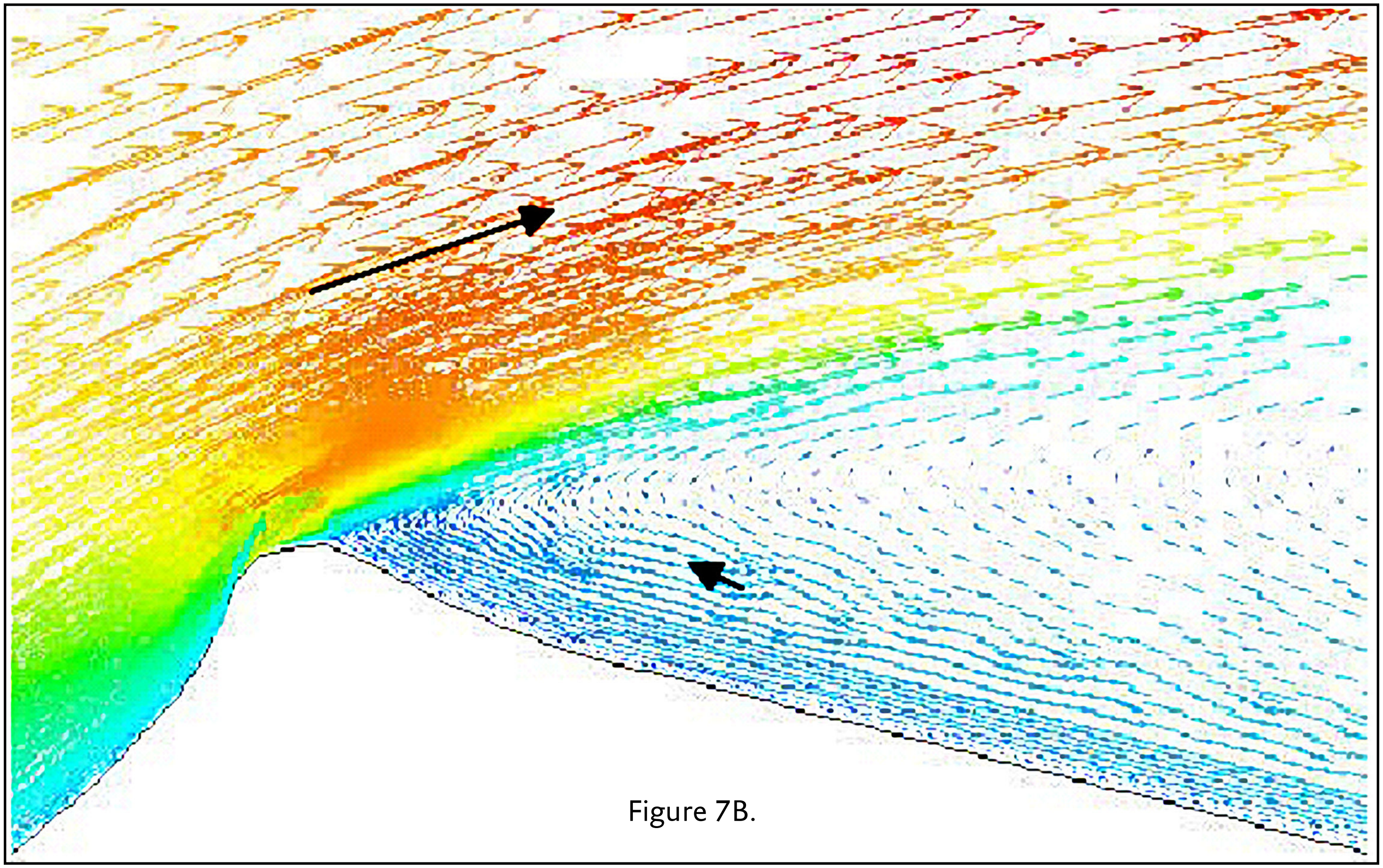


Figure 7B.

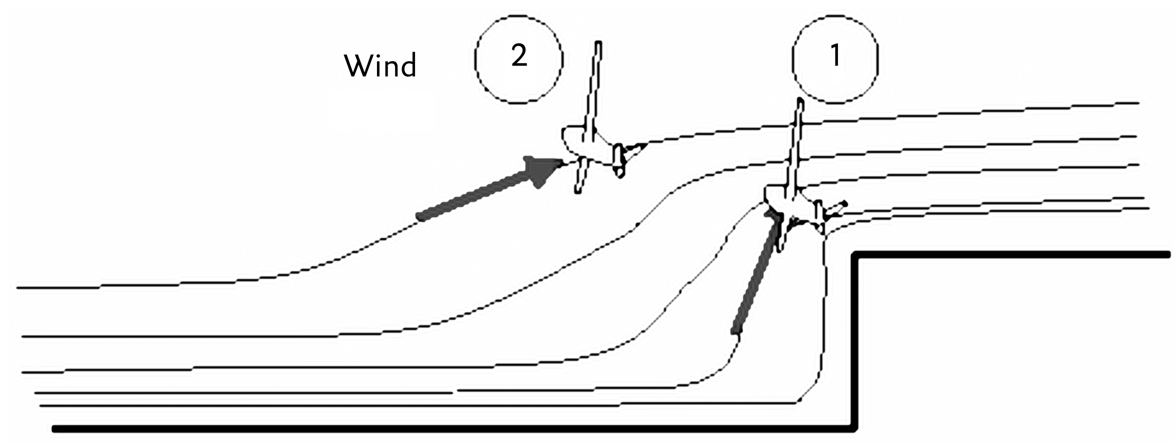


Figure 8.

A solution could be to investigate the backside with some means of visualization. Figure 7A and 7B are some attempts at computing and plotting the wind pattern near landscape, from [4].

6. "German Cap Arkona Turn" analyses

French F3F pilots were amazed at the turn technique they observed at the Cap Arkona Viking Race (2004). The glider first starts with a gentle pull-up while banked. Then it performs a high load turn quite far from the cliff edge, and comes back heading to the cliff with a greater velocity.

For sure this very particular trajectory aims at extracting a maximum energy from the wind pattern over the cliff.

Here is a principle sketch:

- Zone 1 is very influenced by the cliff: the wind here is really vertical, and its speed is high (kind of Venturi effect).

This zone is great for level flight because vertical wind is then pretty efficient, directly to the belly of the sailplane (that is, pretty perpendicular to the path).

On the contrary, when banked up to 90 degrees, you lose the lift tilt, and then the thrust effect due to wind.

- Zone 2 is less influenced by the cliff, that is wind strength is weaker, but more horizontal.

This zone is less efficient for climbing in level flight. But when banked, the glider produces its belly to the wind, hence allowing great energy transfer.

More than taking benefits from wind strength gradient (which may be adverse…), the glider maximizes the energy transfer by performing different maneuvers in different areas of the wind pattern. So, it takes benefit from wind orientation.

By using the so-called "German Cap Arkona Turn," the glider benefits from the thrust effect of wind all over the flight path. This is a typical example where a path permanently suited to the wind pattern will help to reach high speed.

Considering F3F runs, the fact that this technique is efficient or not is also dependent on the effective path length increase, compared to the speed gain.

The thing is, each slope has its own wind pattern, and sometimes around a smoother slope the wind orientation pattern is not well suited for this flight technique.

Summary

The key point about extracting energy from the wind is to fly "belly to the wind" [3].

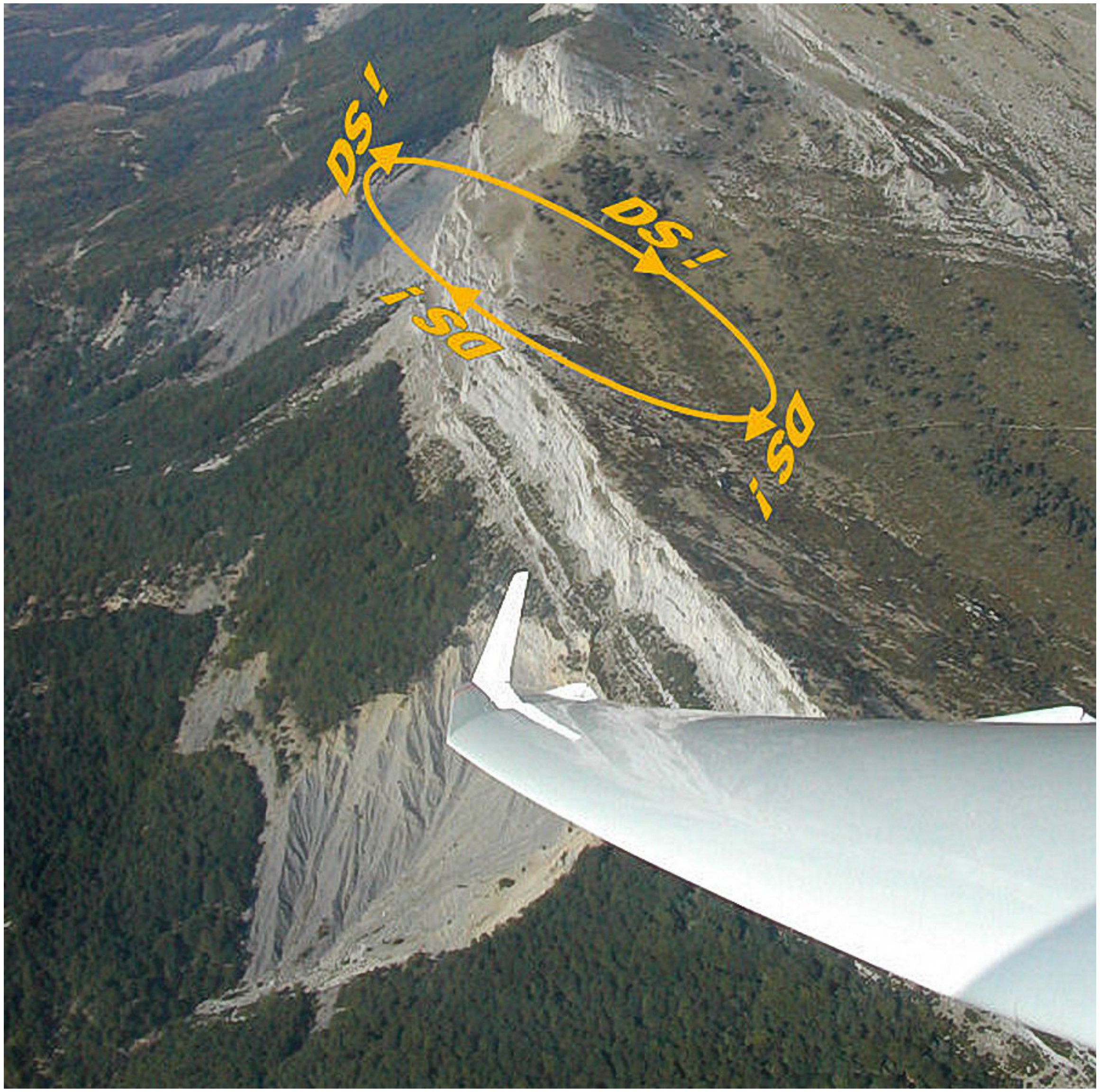
Keeping this very simple statement in mind, we can develop a strategy for better DSing.

- On one hand, if we could see and read the wind patterns, we should try to use trajectories and bank angles to always fly "belly to the wind." Investigation behind mountains would allow having a closer look at this.

- On the other hand, understanding all this may helps us find objects, whatever their geometry, that could allows DSing behind them. Maybe a tree line, maybe a hangar…

The key point is that the wind pattern behind it should be compatible with cyclic trajectories for extracting energy through the "belly to the wind idea"...

I hope this will provide some food for your thoughts!



This photograph was taken during Matthieu's "maiden flight" in an ASW27. Other photos of Matthieu's soaring in the south of France, in the French Alps, can be found at <http://pcii7.tibone.com/gallery/view_album.php?set_albumName=albun81>

References

[1] AIAA 2003-5303. Optimization of dynamic soaring at ridges. Sachs, G. and O. da Costa

[2] Ibis 2005, vol. 147, pp. 1-10. Minimum shear wind strength required for dynamic soaring of albatrosses. Sachs, G.

[3] AIAA 2005-241. Wind energy extraction by birds and flight vehicles. Lissaman, P.

[4] "CFD calculation of the airflow over landscape." Giraud, J. <http://jugiraud1.free.fr>

[5] "Dynamic soaring." Foucher, J.L. <http://perso.wanadoo.fr/dsjlf/>