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R/C Radio controlled Soaring Digest

THE JOURNAL FOR R/C SOARING ENTHUSIASTS

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ABOUT *RCSD*

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 all articles, model designs, press & news releases, etc., are 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. *RCSD* was founded by Jim Gray, lecturer and technical consultant.

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The Soaring Site

Proposed Combat Ban

There is a news page, for those of you not aware of it, on the LSF (League of Silent Flight) web site dedicated to late breaking news to the general membership.

The current posted status on the 'combat' issue was prepared by Dave Garwood:

"The action taken at the July 14 meeting was to ask the R/C Combat Association (RCCA), the AMA Special Interest Group for powered combat, to conduct research and make recommendations to the Safety Committee regarding this proposed rule. The RCCA will prepare a report for the Safety Committee, and it is possible that the AMA Executive Council will receive the RCCA's findings, and may vote on it during the OCT 26, 2002 Executive Committee meeting."

The LSF board's position on this rule is:

"Foamie combat should be allowed!"

For those of you interested in the combat aspect of our hobby, you might want to check out the news page. Then again, you might want to go a little further and have your voice heard.

http://www.silentflight.org

Yes, safety is a definite concern, but it is our hope that any and all issues can be worked out and that "foamie combat flying will be allowed."

Happy Flying!
Judy Slates

SCHEDULE OF SPECIAL EVENTS

October 18-20, 2002
Deep South Soaring Championships Houston, TX
http://home.houston.rr.com/kovacs/hawks/deepsouth.htm

February 1-2, 2003
Southwest Classic Phoenix, AZ

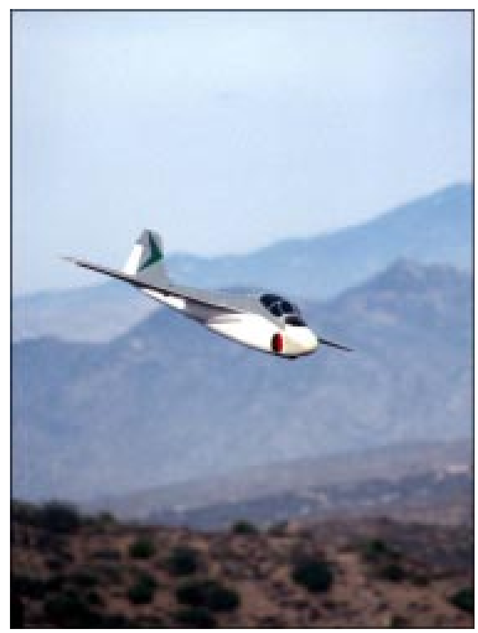
Please send in your scheduled 2003 events as they become available!

Beautiful in full color, both cover photographs are available for downloading from the *RCSD* main web page.

CAJON 2002

Brian Laird's original design, scratch built Air France Aerospatiale Caravelle VI at the Southern California PSS Festival, May 2002.

Photography by Joe Chovan, New York.



BACK COVER

CAJON 2002

Dave Garwood's Walter Bub Grumman A-6 Intruder (Stablemate to Bill Grigg's Walt Bub Intruder at Soar Utah show on *RCSD* cover, SEP 1995).

Photography by Joe Chovan.

on the Wing
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Twist Distributions for Swept Wings, Part 2

Having defined and provided examples of lift distributions in Part 1, we now move on to describing the stalling patterns of untwisted and twisted wings, determining the angle of attack as from the location of the stagnation point, and how wing sweep affects the angle of attack across the semi-span.

Before officially starting this month's installment, we need to clarify something we covered in Part 1. In the section titled "Lift coefficient distributions," sentence four should read as follows: "On the other hand, if the taper ratio is zero (the wing tip comes to a point), the coefficient of lift <u>at the wing tip</u> will be zero only in a truly vertical dive, but otherwise it will be infinite because the wing tip chord is nil." The underlined words need to be added. One could argue that, at least from a mathematical standpoint, if any local portion of the wing has an infinite coefficient of lift ($c_l = \infty$) then the coefficient of lift for the entire wing will be infinite ($C_L = \infty$), but that reasoning does not explain the local condition at the wing tip in an easily understood way. We hope the additional wording makes the situation more clear.

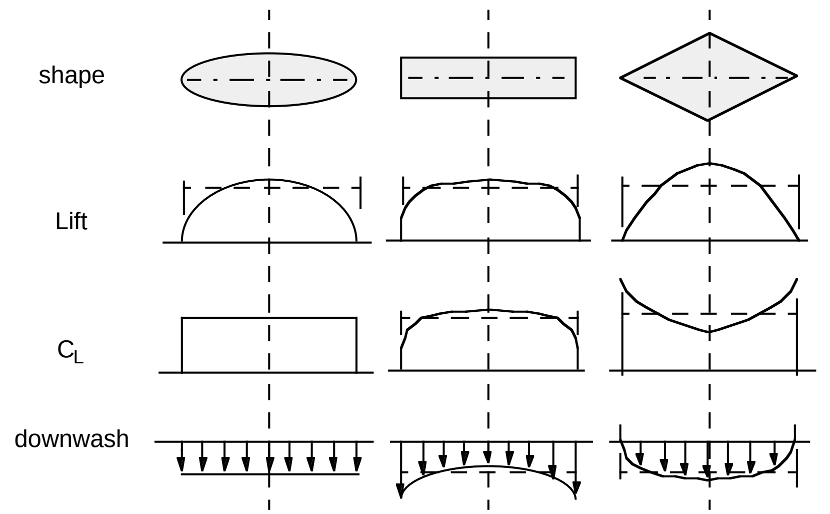

Figure 1. Three wing planforms and their associated lift distributions, coefficient of lift distributions, and downwash distributions.

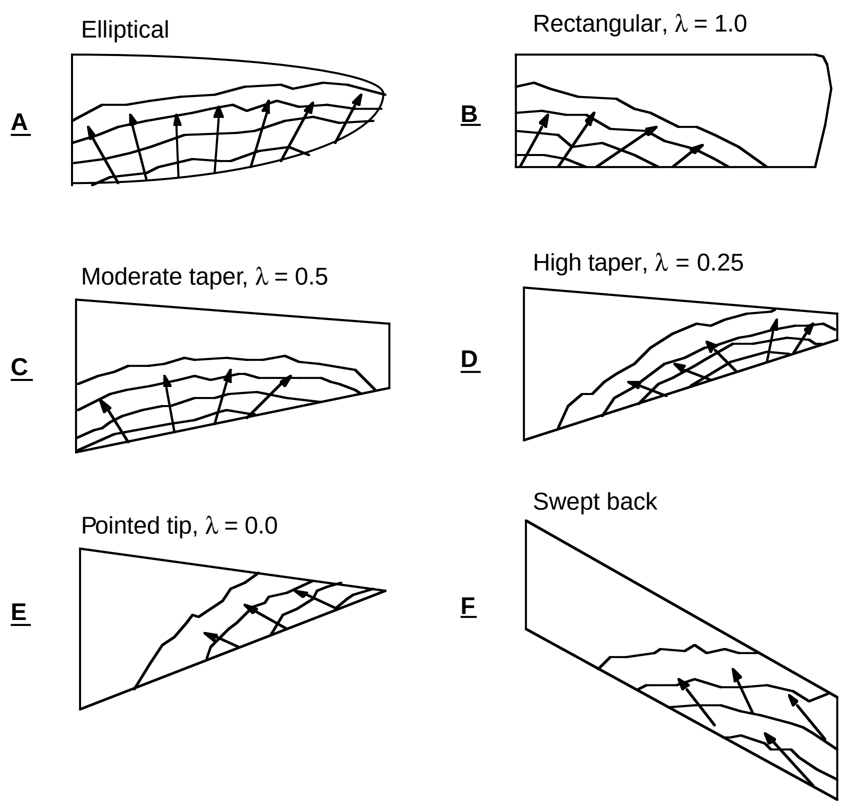

Figure 2. Stalling patterns of various untwisted wing planforms.

Stalling patterns for untwisted wings

The lift generated by any wing segment is a product of the local coefficient of lift and the local chord length. Referring to Figure 1 (a reprint of Figure 4 from Part 1) we can see the results of this formula as applied to three wing planforms. The ideal lift distribution is the elliptical as shown in the left column. Note the local coefficient of lift (c_l) is identical across the entire span, as is the downwash. While the elliptical wing planform is efficient, it is difficult to build and, because the c_l is the same across the span, all segments of the wing are equally susceptible to stalling. See Figure 2A.

The rectangular wing, with its constant chord, Figure 2B, tends to stall at the root first. This is because the local coefficient of lift progressively decreases for those wing segments nearer the tip. This takes some of the load off them, inhibiting stalling. Note also from the middle column of Figure 1

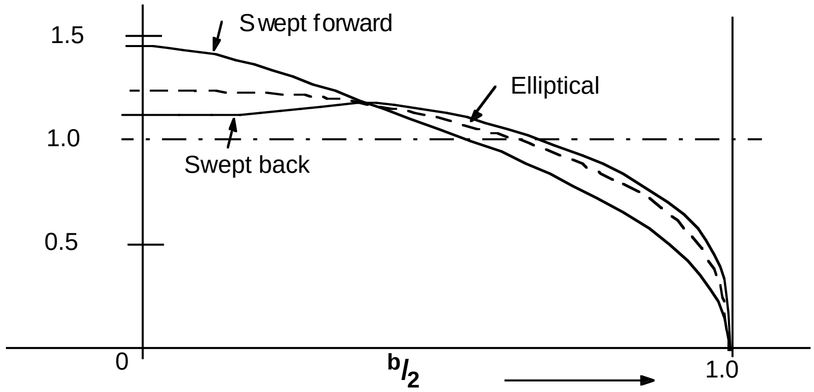

Figure 3. Representative lift distributions for swept forward and swept back wings compared to ideal elliptical lift distribution.

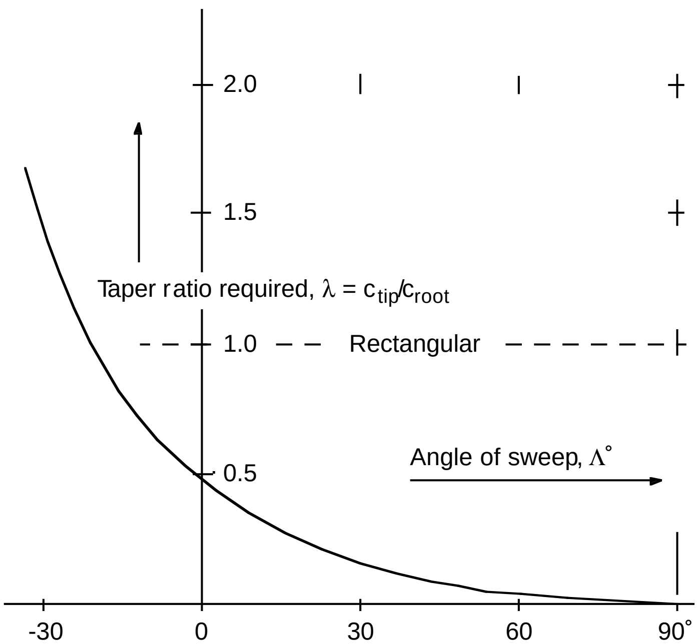

Figure 4. Taper ratios theoretically required for near-elliptical lift distribution for swept wings.

that the rectangular wing tip vortex is quite large, indicating substantial outward flow across the lower surface, and substantial inward flow across the upper surface.

The diamond planform (right column Figure 1 and Figure 2E), unless in a vertical dive ($C_L = 0$) is stalled to some extent at all times. Note that although the local coefficient of lift at the wing tip tends to be infinite, the actual amount of lift generated is very low because of the diminishing chord, and the downwash in the tip region tends to zero. The stalling pattern for this wing planform grows inward from the trailing edge of the wing tip and toward the leading edge. From this information, it does not seem like a delta wing would be useful, but the airflow over a severely swept wing, which a delta is, is far different from the airflow over the straight wing described in this instance.

Wings with large to moderate taper ratios, λ = ~0.4>, have stalling patterns approaching that shown in Figure 2C and tending toward that of the rectangular wing planform (Figure 2B). Wings with small taper ratios, λ = <~0.4, have stalling patterns approaching that of the highly tapered planform shown in Figure 2D and tending toward that of the diamond wing planform, Figure 2E.

The most interesting stalling pattern, however, is that of the swept back wing, as depicted in Figure 2F. Although the wing tip has the same chord as the root, the stalling pattern is entirely different than that of the unswept rectangular wing.

Lift distributions and stalling patterns of swept wings

Figure 3 compares the elliptical lift distribution with representative lift distributions for swept forward and swept rearward wings. The swept back wing shows an increase of lift near the wing tips and a noticeable depression of lift near the wing root. The swept forward wing shows an increase in lift near the wing root, and depressed lift near the wing tip.

Before speaking to why this is so, it should be mentioned that we can attempt to tailor the lift distribution of swept wings to closely approximate the lift distribution of the elliptical planform by modifying the taper ratio. Figure 4 shows in graphical terms the taper ratios required for this approximation as based on the sweep angle.

While we can modify the lift distribution to more closely match the elliptical ideal by adjusting the taper ratio, the stalling pattern does not appreciably improve. The stalling pattern still tends to grow inboard from the wing tip. This is seen in Figure 5.

The swept back wing, when stalled, tends to pitch up into a deeper stall as the center of lift moves forward when the rear of the wing is stalled. As the (elevon) control surfaces are normally placed outboard, they are in a stalled region of the wing. A swept forward wing will suffer from a somewhat similar malady. When the root of a swept forward wing stalls, the wing tips remain unstalled and the center of lift moves forward, pitching the nose up. Aileron control is maintained, but at the expense of a possible severe pitch up and deep stall.

Despite having identical root and tip chords and sharing what some would consider dangerous stall behavior, we bring up these two cases as an example of how sweep can effect the air flow over the wing. The two swept wings in this example have different stall patterns caused by the imparted sweep.

Sweep and angle of attack

An airfoil which is creating lift demonstrates three important characteristics:

- The air going over the top of the section accelerates, the air going along the bottom decelerates. If the smoke stream is pulsed, these velocity differences are easily seen. Figure 6 was derived from a smoke tunnel photograph using this methodology. The acceleration differential is seen in the varying size of the pulses and the varying distances between them. (Some mixing of the smoke with clear air takes place because of turbulence caused by the boundary layer interfacing with air which is moving more rapidly.)
- The air rises toward the section as it approaches the leading edge. This is seen in Figure 6 as well. This portion of the air flow is called the "upwash."
- The air is deflected downward aft of the airfoil section. The section acts as a vane, turning the air stream downward. Termed "downwash," this flow is an important consideration in the design of conventional tailed aircraft as it influences the size and placement of the horizontal stabilizer.

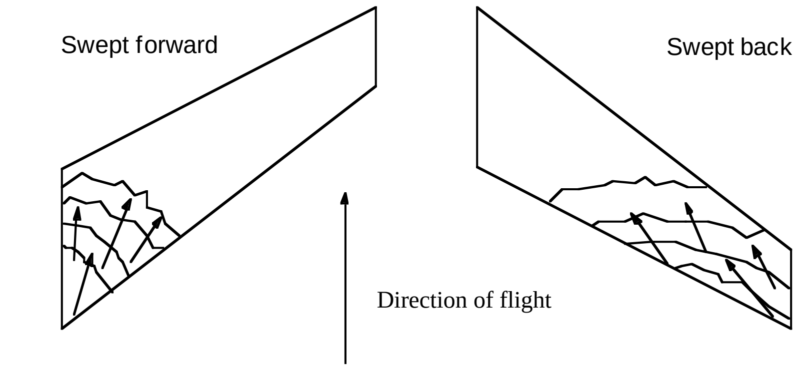

Figure 5. Stalling patterns of swept back and swept forward untwisted wing planforms.

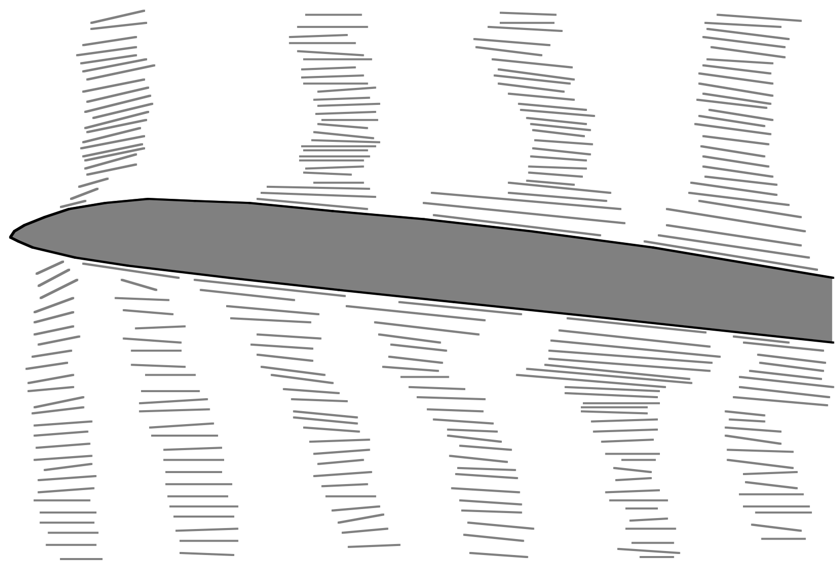

Figure 6. Air flow over a section as visualized through pulsed smoke streams.

Going back to the second characteristic, there is a point near the leading edge where an air molecule actually comes to rest at the airfoil surface. This point is termed the stagnation point, and its location can be used to determine the section angle of attack. As the angle of attack increases from the zero lift angle, the stagnation point moves further aft along the bottom of the airfoil. See Figure 7.

The air flow around a straight wing with an elliptical lift distribution is such that the location of the stagnation point remains consistent across the semi-span. On a swept back wing, we find any segment of the wing has an effect on the upwash of the section immediately downstream and hence outboard from it. The stagnation point thus moves rearward along the bottom of the lower surface, indicating an increasing angle of attack toward the wing tip. Figure 8 provides an exaggerated illustration of this behavior on an untwisted wing. Because of wing sweep, the effective angle of attack at the wing tip is greater than the effective angle of attack at the wing root. It's little wonder the wing tips are proportionally overloaded and subject to stalling.

To maintain a constant angle of attack across the entire span, some amount of washout (leading edge down) must be imparted to the outer portion of the wing. This will reduce the tendency of the wing tips to stall first.

A note about washout

On a conventional tailed sailplane, it is common practice to place some amount of washout in the outer wing panel(s) to assist in reducing the tendency to "tip stall." The problem with this methodology when used on a straight wing is that each spanwise wing segment is seeing the air approaching at the same angle, and the local angle of attack as defined by the location of the stagnation point is entirely dependent upon the segment angle of incidence. When the entire wing is called upon to generate very small coefficients of lift the root is flying at a relatively small angle of attack, and the wing tips may be flying at an angle of attack which is below the

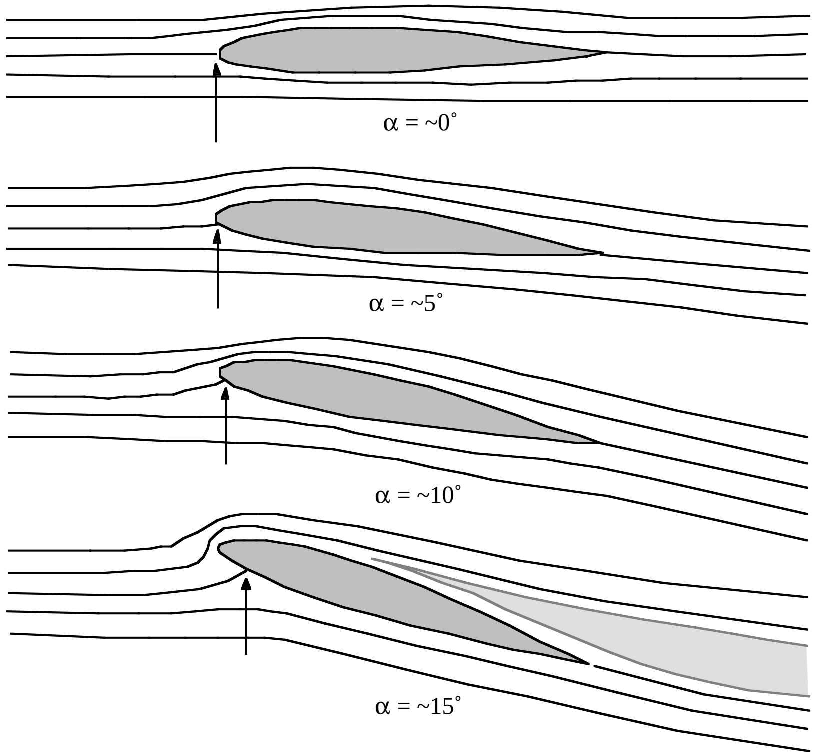

Figure 7. Rearward movement of the stagnation point and increased upwash ahead of wing with changes in angle of attack.

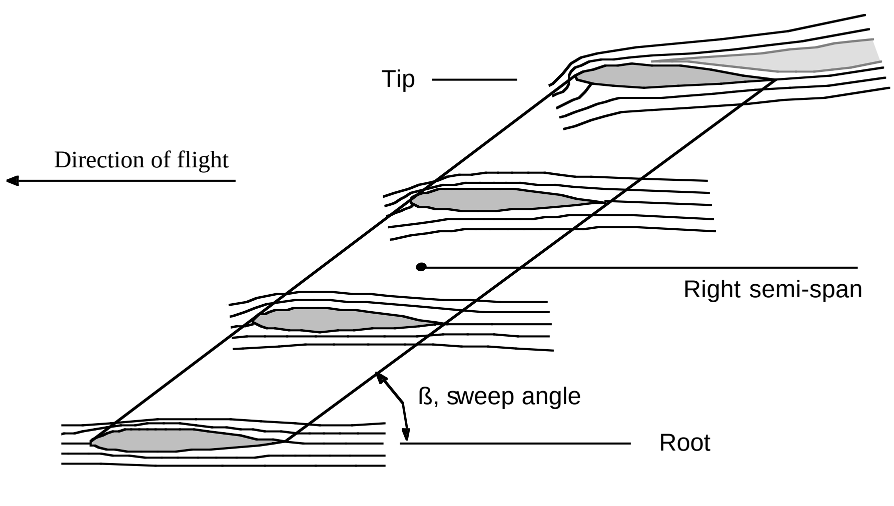

Figure 8. Movement of the stagnation point and changes to effective angle of attack along the semi-span of a swept back wing, exaggerated.

zero lift angle. The wing tip then generates lift in the downward direction. In the 1920's and 1930's, when sailplane designers were building wooden sailplanes with higher and higher aspect ratios, wings with insufficient torsional strength were destroyed by the aerodynamic forces generated by excessive wing twist.

On a swept back wing, the angle of attack as seen by each wing segment increases toward the wing tip. For a specific coefficient of lift, washout can therefore be used to correlate the angle of attack of the wing tip with the angle of attack of the wing root. At some particular speed (C_L) the entire wing will be operating at the same local coefficient of lift (c_l) across the entire span. This is not quite as good as the lift distribution of an elliptical wing, which remains elliptical over a very large range of speeds, but it is a definite improvement over an untwisted swept wing. So long as the root is developing lift, the outboard segments will continue to see an increasing upwash. While required torsional strength is dictated by both sweep and twist, it is handled well with modern design and construction materials and methods.

Are swept wings worth the effort?

From what we've said thus far, it would seem like getting a swept wing to perform in a fashion similar to the elliptical lift distribution, with its accompanying efficiency, would require a major effort. After all, the lift distribution is now dependent upon three variables — sweep, taper and twist — rather than simply taper and twist alone as with a straight planform. The addition of sweep to the design environment magnifies the number of complex computations required.

At this point in our discussion, it would appear the only clear advantages to be derived from a tailless swept wing planform would come from either drag levels lower than those of a conventional tailed airplane or improved handling characteristics, both of which have the potential to significantly improve performance.

Whether the gains to be achieved are worth the time and effort involved in obtaining them has always been open to question. A synthesis of concepts and technology may change that balance in the future. There are avenues of approach, first presented decades ago, which now look quite promising. The advent of low cost supercomputers which are able to quickly run the sophisticated software required to handle exceptionally complex iterative processes is bringing recent advancements in computational fluid dynamics to creative individuals outside the formal aircraft industry.

What's next?

As we mentioned in Part 1, there are three major hurdles to be overcome in order to design an efficient swept wing: (1) achieve and hopefully surpass the low induced drag as exemplified by the elliptical lift distribution without creating untoward stall characteristics; (2) reduce the adverse yaw created by aileron deflection without adversely affecting the aircraft in pitch; (3) maintain an acceptable weight to strength ratio.

This column has focused on the first of these difficulties, and it would appear there may be acceptable solutions available. However, it would be quite valuable to not only achieve the high efficiency of the elliptical lift distribution, but to surpass it. Surprisingly, achieving that elusive goal may be one of the results of solving the second problem, the topic of the next installment.

Ideas for future columns are always welcome. *RCSD* readers can contact us by mail at P.O. Box 975, Olalla WA 98359-0975, or by e-mail at <bsquared@appleisp.net>.

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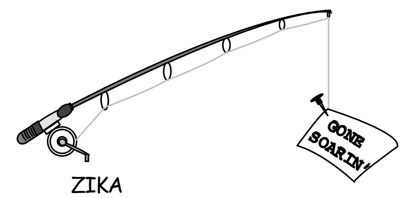

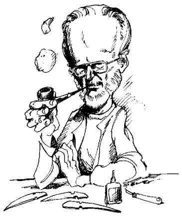

Jer's Workbench

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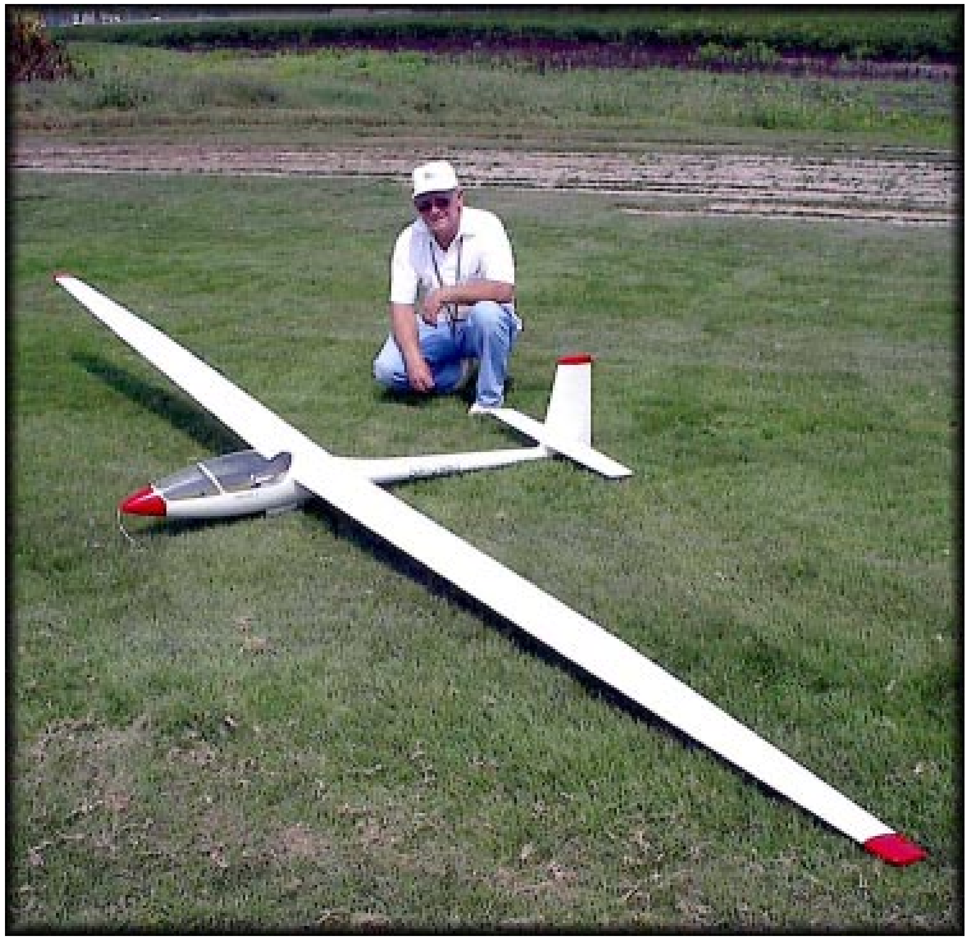

Jantar Glider

As most of you know, I no longer manufacture glider fuselages and canopies, having retired in order to have some fun and go flying, myself.

Of course, that doesn't mean that I don't enjoy hearing from those of you that purchased fuselages from me and the past. One such note arrived recently via e-mail, with a beautiful photograph, that I thought I'd share.

"Hi Jerry:

"The Jantar fuselage that I bought from you last August is now a flying glider. I flew it the 5th. It took about 3 clicks of down and it was headed out of sight.

"I did considerable changing. It has a foam and obechi wing and tail surfaces with the wing having a carbon spar. The wing is in 4 pieces for transporting. It has a Hock retract. I changed the wing section to a HQ3.0/14 to 3.0/12 to 3.5/10. The weight without a detailed cockpit is 12.5 lb. with a 19 oz. wing loading. Seems about perfect.

"I made contact with a fellow in Poland that works at the factory and flies a Jantar 2B in their aero club. He sent me 15 pictures of the airplane and cockpit details so if anyone wants cockpit details I got them.

"The best thing about the Jantar: there aren't too many of them around."

Very Best Regards,
Art Frost
arfly636@att.net

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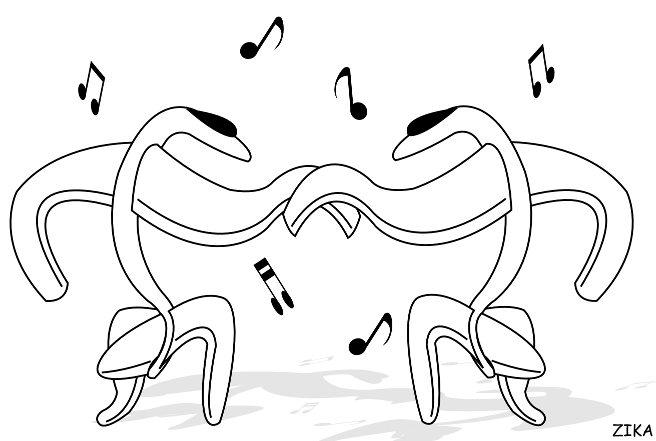

Cajon 2002 — The Best for PSS!

By Joe Chovan
North Syracuse, New York

Photography by
Joe Chovan,
David Garwood
& Carl Maas

Brian Laird's Slope Scale BD-5 in British RAF paint scheme. Photo by Dave Garwood.

Tom Henscheid's Beech-17 Staggerwing, in EPP-Foam. This is a Mountain Toys kit. Photo by Dave Garwood.

Dave Wenzlick's Electric Jet Factory MiG-15, modified for slope soaring. Photo by Dave Garwood.

On May 24-26, 2002 the Inland Slope Rebels (ISR) of Southern California held its 5th annual "Spring PSS Fest." The "bad boys of PSS" are becoming more and more respectable each year, as this event continues to draw talent from all over the U.S. for a weekend of great flying and great looking airplanes.

For the uninitiated, "PSS" means "Power Scale Soaring" models that are slope soaring renditions of full scale planes that have engines. Why model PSS? They look great and usually they fly even better! Most World War II fighters had wing planforms that adapt well to slope soaring airfoils and wing dimensions for efficient unpowered flight — even at shorter more scalelike wing spans.

Once one learns the technique for "high energy flying" — trading speed for altitude and altitude for speed, a well crafted PSS model opens the door to an exciting arena of flying. At a festival like Cajon, you see how beautiful and exciting models can fly with such speed and grace. Here the folks who push the state of the art are more than happy to share this knowledge. Each year the standard for craftsmanship rises as competitors try to top the level of previous creations. It's easy to find inspiration for new projects at Cajon, and I attend year after year to "watch the bar rise." It's the "scale masters" for slope.

While attendance was down slightly from last year, the wind persevered undaunted in the aftermath of September 11, and despite a nation's wariness for travel those who made the trek to the San Bernadino State Forest were treated to 3 days of spectacular conditions. Everything flew: from an 8 oz. BD 5, to a 35 lb. giant EPP Falcon. If you ever wonder, "What will they think of next," then you'll be sure to find the answers at the Cajon festival.

Cajon (pronounced by Southern California locals as "Ca-Hone") is a great site: the wind turns on at noon — not like back East! Daily local heating usually creates a very reliable source of lift, because a large desert behind this mountain pass "sucks" the air channeled through the pass as the sun warms it. The generated wind rushes up and over the mountain to replace the rising air over the desert (the mother of all thermals, so to speak). This is magic to someone who needs to

Event Director Brian Laird makes a fast pass with his BD-5, from a Slope Scale kit. Photo by Dave Garwood.

Jeff Fukushima's Chance Vought F4U Corsair, an original design with molded fiberglass fuselage, balsa sheeted foam wings, and a new Vortech Models kit. Photo by Dave Garwood.

Wade Kloos' original design Messerschmit Me-161 Comet, made from EPP foam. Photo by Dave Garwood.

Brian Laird's Messerschmit Me-262 Stormbird, an original design with molded fiberglass fuselage, balsa sheeted foam wings. Photo by Dave Garwood.

Brian Laird launches a Slope Scale Lockheed T-33 Shooting Star. Photo by Dave Garwood.

wait for storm fronts to randomly cross his slope sites in the Eastern U.S. Reliable lift allows event planners to schedule annual gatherings and this is one reason which proves, at least for slope soaring, "the west is the best."

Not only does Cajon get regular wind, but the Cajon summit boasts TWO hill formations within close proximity that face the prevailing wind. At the festival these are utilized to accommodate either slow or fast planes. The lower hill has a much steeper rise and is a favorite for "slope scale party" half pipes when 5 to 10 planes perform stall turns in tight formation. The upper hill hosts slower, or more delicate planes, for it has a somewhat more gentle rise and landing is a bit easier here. This year the ISR erected a tall pylon flag to separate the flying boundaries for the two areas, and mid air collisions were rare among participants. Brush was cleared to provide plenty of parking, and this year a landing area was created on the front of the upper hill to provide an easy approach away from rotor turbulence.

AWARDS

Best of Show:

Brian Laird - scratch built Caravelle airliner

Best Foam:

1st Ren Dileo - Durable Aircraft Models ME-109
2nd Bob Marks - scratch built Scaled Composites Ares
3rd David Cairns - Modified Combat Models F5 TigerCat
4th Merril Brady- scratch built Bell X-1 rocket plane
5th Tom Henscheid - scratch built Beech 17 Stagger Wing

Best Prop Plane:

1st Carl Maas - scratch built ME-109
2nd Jeff Fukushima - original design F4U Corsair
3rd Ralph Roberts - scratch built P-38 Lightning
4th Russ Thompson - scratch built Spitfire
5th Ian Sanders (12 years old!) - Slope Scale P-51

Best Jet:

1st Dan Sampson - Carl Maas designed Su-25 Frogfoot
2nd David Cairns - modified kit F-4 Phantom II
3rd Mitch Schwartzburg - Slope Scale F-80
4th Jeffrey Alejos - Vortech Models T-33
5th Wes Pearson - Slope Scale BD-5J

Best Civilian Plane:

1st Brian Laird - scratch built Caravelle airliner
2nd Dan Sampson - Slope Scale 60" Super Tucano
3rd Paul Masura - original Design BD-5
4th Rick Schwemmer - Slope Scale P-39 Aircobra
5th Carl Maas - Slope Scale 48" Super Tucano

Event Director Brian Laird flys, Joe Chovan works behind the camera. Wade Kloos' Messerschmit Me-161 Comet flashes by. Photo by Dave Garwood.

(left) Inland Slope Rebels Steve Patton, Carl Maas, Ralph Roberts, and Tim Neja fly at the main hill. Photo by Dave Garwood.

(below) Jeff Fukushima and his super-detailed Chance Vought F4U Corsair, an original design Jeff will be kitting, with molded fiberglass fuselage, balsa sheeted foam wings. Photo by Dave Garwood.

Conditions were very dry, and pilots who needed to retrieve planes which landed below were warned to examine themselves for ticks, as these little buggers were also enjoying the festival and wanted to partake in the action. The temperature was moderate, the air was fast and comfortable, and visibility was very good. It doesn't get any better in the high desert.

Thanks to the Ladies of the ISR who were on site to prepare delicious lunch sandwiches and home made cookies, no-one went home hungry. Who says the desert has to be inhospitable?

So what about the planes? We had planes-o-plenty! Beautiful models gleaming in the bright sunlight adorned the hill for all to see. Between flying, participants walked among tents and sun shades of those in attendance, and enjoyed the spectacle.

In recent years, one may have begun to notice a trend for scale slope competition: "Wider is better." The "fat fuselage" may not be the aerodynamic faux pax most performance designers would shun on sight. When building for competition, a plane that has a truer scale outline will fare better with the judges. The ISR has recognized that the finish on the planes which win the scale events have consistently been immaculate. Reno racers often have super glossy paint, and imaginative hand painted trim. Jet fighters have full cockpit detail and all scale markings down to the numerous "no step" labels. Now a new focus is emerging for setting a challenge to create ships that not only fly well, but more closely resemble their full scale brethren.

For those familiar with "Slope Scale" and "Vortech Models" which arguably have set the standard for today's high performance PSS ships, a notable feature of these birds is that they historically have tended to have very slim fuselage cross sections compared to their wing span. The Vortech T-33

PSS sailplanes ready for static judging. Photos by Carl Maas.

(right) Dan Sampson's Sukhoi Su-25 Frogfoot tank-killer. Built from Carl Maas molded fiberglass fuselage, balsa sheeted foam wings. Photo by Dave Garwood.

and Slope Scale Aircobra are two examples. Stretched wings and slightly enlarged tail feathers are common for scale warbirds, and they certainly fly great with them. However, competitors are proving that a wider fuselage does not necessarily need to hinder performance that noticeably.

It takes considerable engineering talent and an artist's eye to weigh the compromises for good flight performance and faithfulness to scale outline. The builder wants his creation to be obviously recognizable, as "Yes, that's a Japanese Zero," however, he also wants his bird to fly comparable to the fastest and most efficient planes on the slope. This is where great design shines, and legends are made.

At this year's festival, some notable examples include: Jeff Fukushima's F-4U Corsair, Brian Laird's Caravelle airliner, Carl Maas's ME-109, Dan Sampson's Su-25 Frogfoot (Carl Maas design), Ren Dileo's Durable Aircraft Models ME-109 and Bob Marks' scratch built Scaled Composites Ares. All these renditions were either totally unique, or obvious attempts to more faithfully achieve a true scale outline as compared to offerings in previous years. Now one could argue that when Brian flies his Caravelle into 500 foot stall turns, that he is effectively ruining "the scale effect," but when you see him smile as he exclaims "Hey, this plane flies great!" you are compelled to forgive him and just marvel at the small miracle.

Whether for competition, or just fun flying, Cajon provides an atmosphere for anyone who loves PSS airplanes. Here one can see the latest project of master designer and flyer Dave Wenzlick. He certainly seemed to like his new modified Electric Jet Factory MiG-15. Tom Henscheid showcased his new Beech 17 Stagger Wing which flew well. Jack Mullen gave us a demo of his scratch built Bell X-1. Jack had an unusual high visibility white and orange paint scheme for this rocket plane, but explained that a full scale prototype had existed for his rendition which was obviously different than Chuck Yeager's "Glamorous Glennis."

My personal favorites were Reed Sherman's ominous black "F-U2" (reminiscent of the Higgins F-20/crossed with a long winged U2) and Carl Maas's fiercely detailed "tiger stripe" F-80. Carl's plane is yellow with black stripes sporting orange accents. His super glossy slope rocket was a re-build from a former Shooting Star project and as finished was very heavy (over 50 oz.). Both these planes ate up the sky and virtually reigned supreme in the half pipe scene. This is what dreams are made of, my friends.

Rumors have been flying that in the future the ISR may host this event only every 2 years, possibly to avoid conflict for those who attend other soaring events — most notably Soar Utah (which is biannual). This year the ISR did its usual super job in organizing and promoting the festival, so I'll trust if they decide to go to a 2 year format, it's for many good reasons. Regardless, the camaraderie, good natured competition, and superlative flying conditions virtually guarantee a great time at Cajon. If they hold it, I will come. Hope to see you there as well.

———

For more information about the Inland Slope Rebels and future events see the ISR website at:
ourworld.compuserve.com/homepages/ISR

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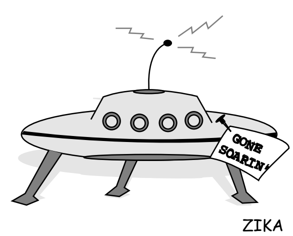

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GORDY'S TRAVELS

Gordy Stahl
Louisville, Kentucky
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Does Your Tail Hang Down? Understanding Nose Weight, Lift and Sink

I have been traveling (soaring) the Ontario area of Canada lately, and I met another couple of guys who I wish were part of my Club: Scottish Canadians with Austin Powers accents, who happen to be flying Stratos and Extreme molded open class sailplanes. Both these guys are talented modelers having contest winning records with years of experience, so like your local 'top guys' it's assumed that they understand air and sailplanes.

I was explaining my method for balancing a sailplane (*RCSD*, April 2002), and one of the gents mentioned that when he had his plane balanced close to neutral, it would 'hang its tail' and mush… And he thought that was a bad thing. He thought that by adding weight to the nose, it was solved. I knew he had things backwards but I figured it would take some convincing to get him to believe otherwise. So I asked if I could do a few hand tosses of his plane to see how its trim and balance felt to me.

The first toss was as expected, an immediate 'balloon' from the speed of the initial toss, then a quick drop of the nose, lots of stick corrections needed to get it flying on its own and the usual sharp glide angle to the ground. I tossed it twice to confirm what was causing the action of the sailplane.

Its nose weight caused a need for up elevator in order for the plane to fly level (at cruising speed). That up elevator is what caused the initial ballooning on the toss. The loss of airspeed at the top of that balloon meant a loss of authority of the elevator, which meant no ability to hold the weight in the nose. The weight in the nose causes the deep glide angle (and high landing speeds, ESPECIALLY with the use of flaps).

None of that sounds beneficial to getting our contest times or creating a sailplane that can indicate and take advantage of light lift, or is easy to 'drive' into the 100 point spot… And it isn't.

So, what about the 'hanging tail'? Let's take a look at the model again. Consider the 'balance point' of the model to be the 'teeter point'. The nose weight being a 'heavy kid' and the tail being a 'light kid' sitting on a teeter-totter (fuselage) with one side longer than the other. The wing as a sort of 'dampener' that tries to hold the fuselage level… As long as the uneven teeter-board (fuselage) is balanced just right on its back.

If the fuse (with rear parts) is set just right on the wing, it's easy to get that wing to move to tip in either direction.

Now be careful here, don't get confused with this analogy. The light kid (elevator end) has the ability to change his weight! The light kid is our elevator and its 'lever' strength (authority) increases with airflow (speed).

So, let's go back to the teeter-totter. Let's say that at the 'average' wind speed the kids are balanced parallel to the ground. But as the wind increases, the light kid drops, the heavy kid goes up. As the wind decreases, the heavy kid drops. And at no wind speed, the heavy kid BANGS into the ground for a butt busting jar. (If it's our sailplane, the nose breaks off and the tail boom snaps!)

The light kid's (elevator) weight changes with airspeed because he can only keep his heavy friend from dropping to the ground and the 'teeter-totter' level while at a specific airspeed in this analogy. Since he is our elevator, our elevator has some 'up' in it so that at that specific airspeed it can hold/match the weight of the heavy kid (nose weight) on the other end, keeping the board/fuselage level.

Let's not forget that wing and its desire to hold an angle of attack (its relationship to the ground). As we know when we put our hands out the window of the car on the highway, when its edge is held parallel to the airflow it slips through the air fairly easily, but when tipped up there is a violent reaction. It takes an effort to hold it from tipping violently up or down. I didn't say a LOT of effort - I said AN effort. The lengths of the front and back of the fuselage act as the controller for the wing's pitching (tipping) movements.

So, since the wing needs a mechanism to keep it from uncontrolled attitude changes, the fuselage acts as a movement dampener. The elevator acts as the attitude controller. If those things are true, then it is the nose and tail moments that most effect the wing's 'tipping' response, or lack thereof. It is not intended to provide 'control'. Proper nose weight is set to determine an optimum degree of average wing angle of attack… And the elevator is there to provide directional control, not dictate average and optimum angle of attack.

Okay, so maybe that's not strictly scientifically correct, but in general that's the reality… In our use... IF we have a full flying stabilizer and a 'balanced' sailplane, one that doesn't use elevator angle of attack to CORRECT for needless nose weight.

Back to the Hanging Tail

We all know that when there is lift (energy blasting upwards) it is indicated by our plane's TAILS popping up (not the noses). It's because energy is actually rushing under our plane's wings and tails. Our planes come alive, become lively, speed up, and react in this condition, especially if they are very energy efficient, as in not carrying the nose with the tails. A nose full of lead means a tail that is pushing down in back.

When the air is dropping on TOP of our plane (sink) they become sluggish, mushy, resist control inputs and the tails drop…. Because the tails are way back there and the air dropping on the stabs push the tails down. And that is not a 'good' thing. It's a GREAT thing.

With an unbalanced plane (nose heavy, cuz you won't be able to fly a tail-heavy plane at all), instead of the tail rising in lift (remember its got UP elevator forcing it to stay down), and dropping in sink conditions (the heavy nose drops cuz of the lack of elevator authority and the whole plane sinks instead of the tail), you get no indication of sink conditions. In fact the plane speeds up, making you think that you are in good air, when in fact the plane is getting airspeed (instead of rising energy) from its nose over fall.

Trim and balance is a whole other exciting part of our hobby, that goes beyond the color of the plane, the foil, span, servos, materials and the air reading part.

So often we hear of a pretty cool sailplane that flies terrible… I never think twice about comments and reports like that, because I have no idea if that plane was trimmed and balanced to its optimum before an evaluation was conducted.
I hear the comment, "I like to fly my planes a little nose heavy cuz they are 'more' stable," I cringe... Because I know it will be a matter of time before I see that guy's model sitting in a tree, lost down wind, or with a leading edge dent from the guy's shin.

There is never a good payback to flying a crooked sailplane. Don't get me wrong, a crooked sailplane is not a 'tuned to taste' sailplane... To paraphrase Joe Wurts:

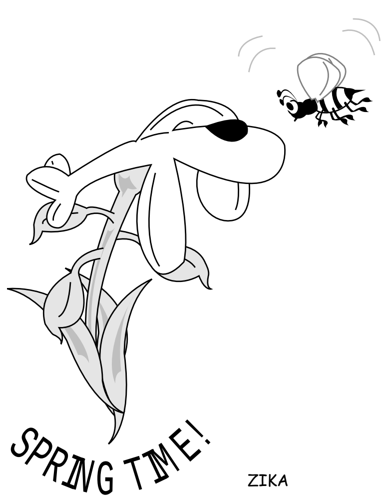
> *I used to fly my planes almost negative neutral because I like the way they indicated the lightest lift. But now that my eyes are not what they used to be, I have moved my balance point so that my plane is not as reactive to lift as it used to be. It let's me relax some when my plane is way up and out.*

Notice he didn't say nose heavy. Balanced to taste AFTER finding the balance point definitely affects the efficiency of the sailplane, but the benefit far exceeds the loss.

Go back and read "Gordy's Balancing System," find your planes optimum balance point, and then 'tune' from there. It's the journey that's the most satisfying, not the destination!

See you next trip!

■



Excerpts from:

"Gordy's Discus Launching Seminar"

(Spoken with that weird yankee accent...)

Paul Cox
Fairdale, Kentucky

(Submitted by Gordy when Paul wasn't looking... Ed.)

"Everybody shut up and come here. I'm about to start here..."

"OK, you wannabes, you got your discus launching planes, and everybody is ready except Larry. (Larry put his wing peg in the middle of the boom so...) He's going to need some help from one of you other guys."

"OK everybody, eyes up front here. This is the way you hold your plane by the tips of your fingers, the other wing starts out on the ground."

"If you're right handed, your left shoulder should be pointed into the wind. No, no, Larry, turn around. Your other left - geez..."

"OK, now, with your left foot pointing into the wind and your right foot pointing out in front of you... That's my foot, Larry...   Get off of my foot, Larry..."

"Geez! Ahem..." (Lord, give me patience...)

"Ok, now we slowly turn to our left, with the model in level... Ow! Damn it, Larry. Back up a few feet there. Geez..."

"And, when we release the model after a full turn, it should be pointing into the wind... Larry, get up off of Tim! You're crushing him..."

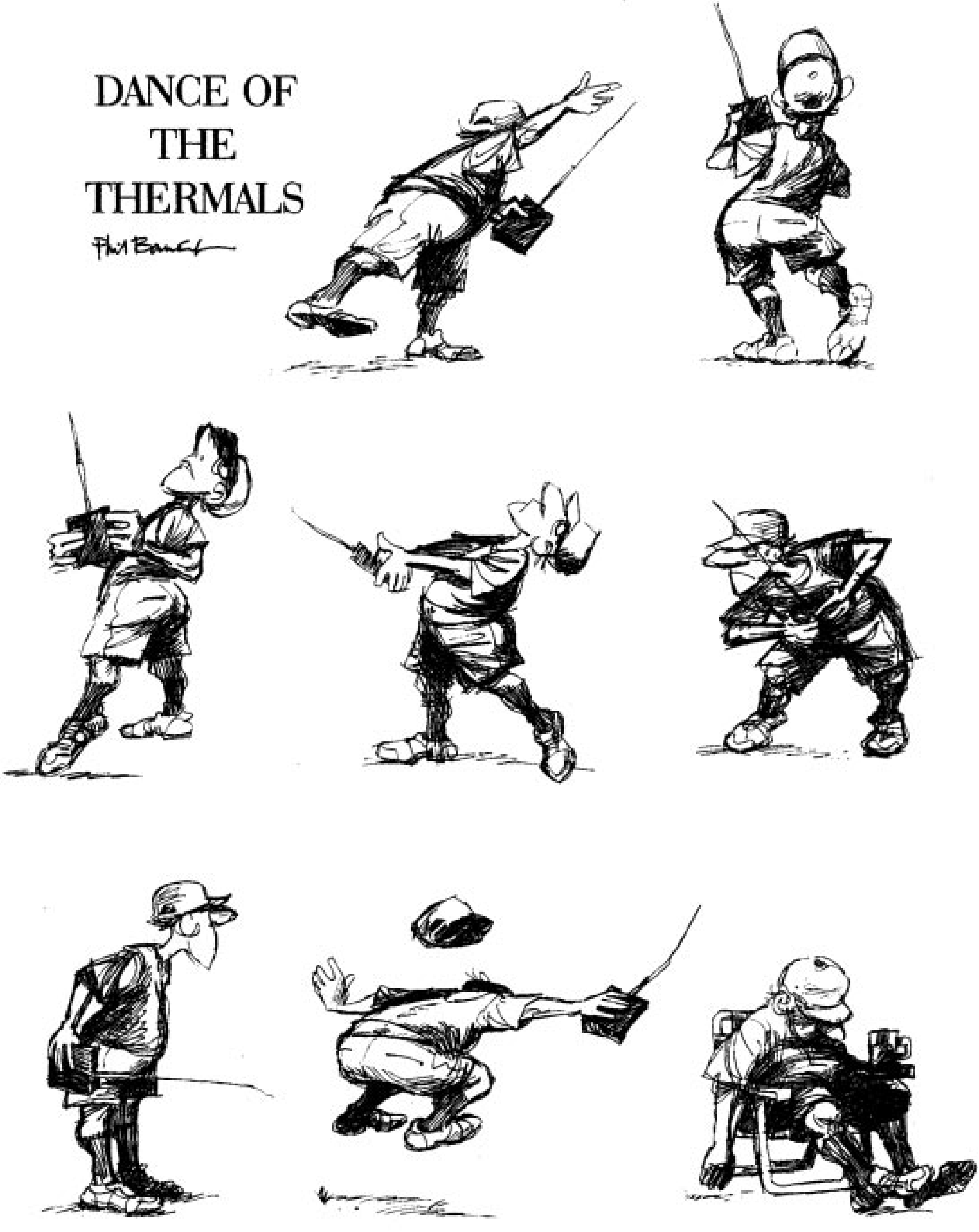
"Larry, c'mere for a second. I want to whisper something to you..." (CENSORED)

"Gee whiz, you guys need help, a lot of help..."

Class ends with Gordy getting in his truck and heading off to work, where he's sure he'll have more fun...

■

DANCE OF THE THERMALS



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Reference Material

Summary of Low-Speed Airfoil Data - Volume 3 is really two volumes in one book. Michael Selig and his students couldn't complete the book on series 3 before series 4 was well along, so decided to combine the two series in a single volume of 444 pages. This issue contains much that is new and interesting. The wind tunnel has been improved significantly and pitching moment measurement was added to its capability. 37 airfoils were tested. Many had multiple tests with flaps or turbulation of various configurations. All now have the tested pitching moment data included. Vol 3 is available for $35. Shipping in the USA add $6 for the postage and packaging costs. The international postal surcharge is $8 for surface mail to anywhere, air mail to Europe $20, Asia/Africa $25, and the Pacific Rim $27. Volumes 1 (1995) and 2 (1996) are also available, as are computer disks containing the tabulated data from each test series. For more information contact: SoarTech, Herk Stokely, 1504 N. Horseshoe Circle, Virginia Beach, VA 23451 U.S.A., phone (757) 428-8064, e-mail <herkstok@aol.com>.

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Internet soaring mailing listserve linking hundreds of soaring pilots worldwide. Send msg. containing the word "subscribe" to soaring-request@airage.com. The "digestified" version that combines all msgs. each day into one msg. is recommended for dial-up users on the Internet, AOL, CIS, etc. Subscribe using soaring-digest-request@airage.com. Post msgs. to soaring@airage.com. For more info., contact Michael Lachowski at mikel@airage.com.

International Scale Soaring Association

There is a growing interest in scale soaring in the U.S. We are dedicated to all aspects of scale soaring. Scale soaring festivals and competitions all year. Source for information on plans, kits, accessories and other people interested in scale. For more information:

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Books by Martin Simons: "World's Vintage Sailplanes, 1908-45", "Slingsby Sailplanes", "German Air Attaché", "Sailplanes by Schweizer". Send inquiries to: Raul Blacksten, P.O. Box 307, Maywood, CA 90270, <raulb@earthlink.net>. To view summary of book info.: http://home.earthlink.net/~raulb

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A Division of the Soaring Society of America

The purpose of the Sailplane Homebuilders Association is to stimulate interest in full-size sailplane design and construction by homebuilders. To establish classes, standards, categories, where applicable. To desiminate information relating to construction techniques, materials, theory and related topics. To give recognition for noteworthy designs and accomplishments.

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