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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

New Web Address

We received an e-mail from Buzz Waltz. He has new e-mail and web addresses:

www.buzzwaltz.com
buzzwaltz@earthlink.net

E-Mail Problem

We recently received the electronic version of the Tulsa RC Soaring Club newsletter, *TULSOAR*, from our Dave Register, who is also their newsletter editor. We noted that he has been hit with an enormous amount of spam lately and has been trying to aggressively block the unwanted junk mail. And, he's not the only one! So, I dropped him a message in case he could offer suggestions on getting rid of the mail other than shift/click/delete...

Dave responded with, "No luck so far. I downloaded a spam blocking program for AOL but it was so cumbersome it wasn't worth it. I'll keep looking. For me, all I need right now is something that catches a few keywords in the subject line and rejects them before they get here. Things like 'mortgage', 'credit', 'debt', 'viagra' and then a whole host of body parts that don't need listing here.

"AOL 8.0 allows you to automate the blocking part a bit. But it works only for specific e-mail addresses. So far I've got a list that's approaching about 200 addresses. I'm sure they keep hopping around with these things so it's essentially useless.

"If I find something that works, I'll let you know. This has become more offensive than telemarketers. At least with caller ID you don't have to answer the phone and you can turn your answering machine off during peak times. But this stuff is overwhelming and much of it is in overwhelmingly bad taste."

And for those of you that know what we're talking about, "overwhelmingly bad taste" is obviously an understatement!!

Since about 90% of our mail is spam, that means we delete a lot of e-mail without even bothering to open it. If we don't recognize your e-mail address and the subject line fails to indicate that the message is somehow RC related, the message is deleted. If any of you have sent a message, and we have not responded, please send it again, but with a different message in the subject line.

The Tulsa folks and *RCSD* aren't the only ones to address the e-mail problem. Raul Blacksten, editor of *Bungee Cord*, addressed the subject in his Winter 2002-3 editorial. He said, "Also, please know that if you e-mail me, be certain that what you put in the subject line is clearly and concisely stated so that I know your attachment is not a virus. I have been hit by viruses over 300 times since June. Even if your message gets past my Norton antivirus software, if it is at all questionable, I delete it rather than take a chance opening it."

And, what is Bungee Cord? As many of you already know, it's the Voice of the Vintage Sailplane Association!

Vintage Sailplane Association (VSA)

http://www.vintagesailplane.org

The following information was obtained from the VSA web site. Like our discussion on T.W.I.T.T. last month, we thought some of you would be interested in the scale aspects as they relate to our RC models, or perhaps you'd like to attend one of their yearly events as a spectator or even a volunteer.

"The purpose of the **Vintage Sailplane Association (VSA)** is to promote the acquision, restoration and flying of vintage sailplanes by its members, and to assist the **National Soaring Museum** in the preservation of soaring history and the promotion of vintage sailplane activity.

My Golden Retriever

Designed and built by Dick McDonald, a member of the Seattle Area Soaring Society, Dick shares his Golden Retriever design in this issue of *RCSD*.

(Thanks to B² for editing, coordinating, and transmitting! Article is also available on the *RCSD* web pages in pdf format! Ed.)

Back Cover

The Ronnie Winch

Designed and built by Ronnie Woodyard, he shares his Ronnie Winch design this month in Tom Nagel's travel saga column, "Have Sailplane, Will Travel!"

"A **Vintage Sailplane** is any glider out of production since 1958, or a more recently built glider with appearance, performance and construction characteristics similar or comparable to gliders manufactured before 1958.

"A **Classic Sailplane** is a glider that is at least 25 years old, but is not categorized as a Vintage Sailplane.

The Vintage Sailplane Association
1709 Baron Court
Daytona Beach, FL 32124

Classic Division

"Classic sailplanes are defined as gliders more than 25 years old. This distinguishes them from Vintage Sailplanes, defined as any glider out of production since 1958, or a more recently built glider with appearance, performance and construction characteristics similar or comparable to gliders manufactured before 1958.

"The Classic Sailplane Division, chaired by Jim Kellett, addresses the needs of the older (but not Vintage) sailplane owner, pilot, or enthusiast.

"Owners or enthusiasts of Classic Sailplanes are encouraged to initiate and manage websites for their type. Webspace is available free of charge for such sites through the generosity of a donor - if you're interested, contact Al at asw22pilot@bigwings.org. (The sites hosted on his server can be seen at http://www.classicglider.info.)

"There are several interesting challenges to the owners and pilots of Classic Sailplanes. Many in this fleet are the earliest examples of the major shift in the design, construction, and materials of sailplanes toward FRP construction (vice wood, metal tube, fabric, and metal monocoque). However, there are far fewer repairman in the general aviation community qualified to work on FRP materials, at least compared to those skilled in working with earlier materials. In addition, many manufacturers are hard pressed to provide technical support to this aging fleet, especially with the actual numbers of a specific make and model are relatively small. One of the most important contributions of the Classic Division is the promotion of "self-help" information within the community of owners and pilots.

"Therefore the Classic Division encourages the development and maintenance, by volunteers, of websites devoted to specific machines which qualify as Classic. (See the links to known sites at the bottom of this page.)

"Type Sites" for Classic, near-Classic, and Vintage Sailplanes:

Briegleb BG-12/16
BG-12B
Duster
Fauvel Flying Wings
Ilindenka (The only Macedonian Sailplane)
Libelle (Is this one inactive??)
Libelle (Carl Neidermeyer's Page)
Rolladen-Schneider (The "LS" Gliders)
Schreder Sailplanes
Schweizer SGS 1-20
Schweizer SGS 1-26
Schweizer SGS 1-35
Schempp-Hirth Austria SHK
Schempp-Hirth Mini-Nimbus
Schempp-Hirth Cirrus
Schempp-Hirth Standard Cirrus
Schleicher ASW-19
Schleicher ASW-24

CALENDAR of EVENTS

The 2003 Eastern VSA Regatta will be held at the Kutztown PA Airport May 23 - 26 2003.

"They have a Cessna that can tow slow, a winch and three grass runways in addition to the paved one. Some interesting stuff for sale, too. A good restaurant a few steps from the staging area. Camping allowed, Motel list to be published later. Mark you calendar. This should be a good one. Kutztown is located NE of Reading PA adjacent to Hwy 222, and close to Interstate 78.

VSA National Rally - August 23rd to September 1, 2003

"The Vintage Sailplane Association is planning to hold its first ever VSA National Rally from August 23rd to September 1, 2003 at the Mountain Valley Airport in Tehachapi CA. There will be lots of vintage and classic sailplanes flying and on display. Other activities include various tours of area attractions, nightly BBQs, various speakers and an El Mirage Dry Lake expedition. There will be both Aero and Auto tows available as well as our famous western soaring conditions. This will be a great opportunity to pursue some of your Silver, Gold and Diamond Badge legs in your vintage and classic ships. SSA observers will be available all week. The week will end with the Sailplane Homebuilders Association's Western Workshop where there is much more fun to be had. Make your plans now to attend.

Contact:
Jeff Byard
13555 El Camino Real
Atascadero, CA 93422
805-461-0488; jbyard@thegrid.net

Seventh Annual Midwest Vintage/Classic Sailplane Regatta - June 7-15, 2003

"Sponsored by: Vintage Sailplane Association, Wabash Valley Soaring Association and Mid-America Air Center Located at (38 46' N 87 36' W) near Lawrenceville, Illinois.

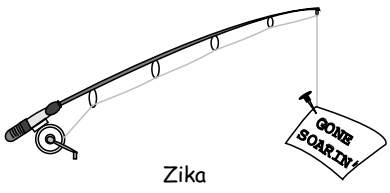
"Come join the fun, show off your vintage/classic glider. limited hangar space available, first come! Bring your ship and fly with us. 2000 ft. tows $25.00. Buy one month membership for $100.00 and check out and fly in our Schleichers for club rates. 2000 ft. tows $15.00, Glider Rent $10.00/hr.

"Cookouts many evenings or meals at local restaurants or pubs. Nearby motels and camping (or camp on the field).

Contacts:
Bud Brown (618) 943-2076
RR 4, Box 51,
Lawrenceville, IL 62439
or
Dave Schuur (618) 584-3328
16705 E 300d' Ave
Flat Rock, IL 62427
dschuur@frtci.net

"Tell us you're coming & what glider you're bringing! If you don't have a ship, just come and have fun."

Happy Flying!
Judy Slates



Zika

Winter Time Projects

by Paul Cox
SoarCrashnburn@aol.com
Fairdale, Kentucky

Ahh, winter is here! Now's the time for me to dive back into that not quite finished super project plane, the construction of which has been plagued by the mysterious disappearance of packages needed to complete my project. Sometimes, I wonder if the packages were routed through the Bermuda Triangle or simply took a slow ship trek around the world...

My current 2 year project is an ACME products AGF-9000. It has some state of the art components and was likely designed entirely by a mad scientist who had way too much time on his hands!

Once I have obtained the unique list of components, combined with the skill of my craftsmanship, and 3 tons of blind luck, I will be able to out-soar anybody on the planet, maybe even Gordy. (I once thought Gordy was able to see thermals, but I now realize that he always travels in the direction of the oncoming fronts. This, of course, explains how he knows where all the thermals are; he's been through them all before.)

It hasn't been so easy obtaining all of the parts for this plane. The servos came from the actuators of a solar collector that could have been on a retired Japanese satellite, the 100-thread count coconut spar wrappings from Guam are probably surfing around in the Bermuda Triangle, and the pull-pull system which is made entirely of knitted spider web collections is a work in progress. (My grandma was working on this, until that nasty spider bite took her from us, rest her soul. My other grandma has taken over for her, and so far, has been doing a pretty good job.)

The wing ribs are still at my ex-wife's house. She threatened to actually throw them away last year, until I reminded her that I made them from her great-grandmother's cypress rocker, and that they were the only keepsake she had left.

I also have to send a letter to the Vatican. I am trying to find something which wasn't in their catalog this month. Does anybody out there know the item number for about 3 grams of dehydrated holy water ballast? (Just kidding, guys...)

I did get a special handmade battery pack for this plane a couple years ago, a state of the art NiCad pack, which reminds me, I guess I better look into ordering a different charger thingee for that battery.

This project has been delayed so many times that I sometimes forget about it; it seems that every time I mix the resin and the hardener together, we always end up having a big party that night, and then I have really bad headaches for days.

All joking aside, before I head back to the workbench I wanted to remind everyone to be careful with their hi-starts. This cool weather can make them brittle, and they can snap.

Which reminds me; keep your car running in case you have to make a quick exit from the flying field. Dead batteries won't allow for a quick getaway should the residents of the Bermuda Triangle come after your plane stuff! ■

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The Myth of the Bell-shaped Lift Curve

By Martin Simons
Stepney, Australia

As many already know, a Horten IV sailplane has been restored and is now displayed at the Oberschleissheim division of the Deutsch Museum, just outside Munich. Although this surviving example might be capable of flying it will not do so, being preserved as a museum exhibit.

However, Professor Berndt Ewald, formerly of Darmstadt Technical University, is hoping to get a new Horten IV tailless sailplane built (full scale) and flown. Whether he will be able to find time and financial support remains to be seen but it would be most exciting to see one of these famous sailplanes in the air again after so long. It would also give us a chance to answer some outstanding questions.

I wrote most of what follows in the first place for the International Vintage Glider News magazine, in which future developments of Berndt's project will doubtless appear from time to time. With a few appropriate changes, it may be of interest to model fliers too.

The Horten brothers, Walter and Reimar, from 1934 produced their series of tailless sailplanes and powered aircraft. Great things were claimed and much was expected.

What the Hortens did, for which they deserve much credit, was to persist with their tailless designs until they had a sailplane that may have been nearly as good as the best of the contemporary orthodox types. Eric M. Brown, the famous test pilot, wrote in 1983: "They persevered where others have given up. I only wish I could share their enthusiasm and faith."[1]

In the end there was disappointment. Hans Zacher, much of whose life has been devoted to test flying and measuring the performance of sailplanes, has written, "Unfortunately, in earlier reports many facts have been hidden and others have later been realised to be wrong. Often self-praise occurred and so-called flight measurements have not been physically exact."[2] He continued, "One has to emphasise that with tailless aircraft it is more difficult to find the necessary compromise between good performance, desirable and safe flight characteristics, easy handling on the ground and cheap construction costs, compared to 'normal' aircraft."

Reflexed profiles and centres of pressure

Contrary to some claims, the Hortens did not make any astonishing discoveries. For example, they have been credited with being the first to realise the benefits of the so-called reflexed wing profile. This is wrong. Wind tunnel tests on reflexed wing sections had been performed before 1924 and the results widely published. Alexander Lippisch used them for the 'Storch' series of tailless aircraft. There were many examples available to designers before the Hortens began their work. In the old-fashioned terminology, reflexed profiles have a centre of pressure which does not move appreciably at the changing angles of attack normally used in flight.[3] Unlike the ordinary cambered type of profile, they do not try always to push the nose down. (The nose down pitching tendency of the usual type of wing is normally resisted by a tailplane or a canard forewing.)

If there is no tail a reflexed wing profile which does not require the nose-up balancing force is an advantage for balance and trim but to use them is to sacrifice some performance. In terms of lift and drag, reflexed profiles are relatively inefficient.

Flutter

There were other difficulties which the Hortens never solved. One was wing flutter. Karl Nickel wrote, "I have experienced flutter with the tailless sailplanes Horten H IV. Beginning at approximately 140 km/h (87 mph) it started to rattle and shake and to flap

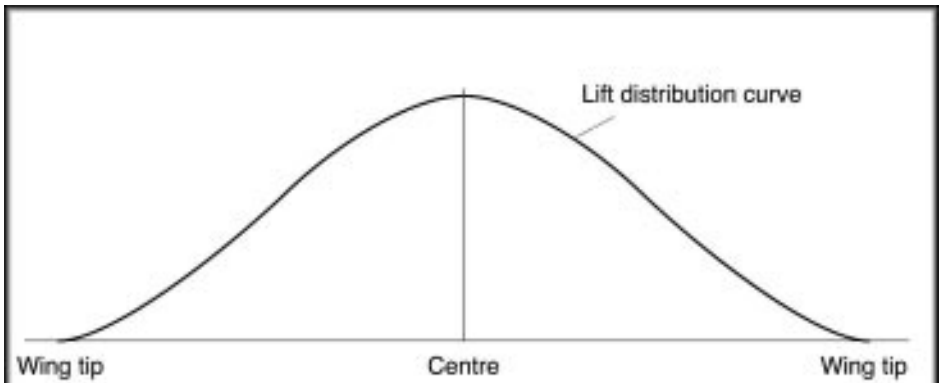

Figure 1 The Horten's 'bell-shaped' lift distribution curve

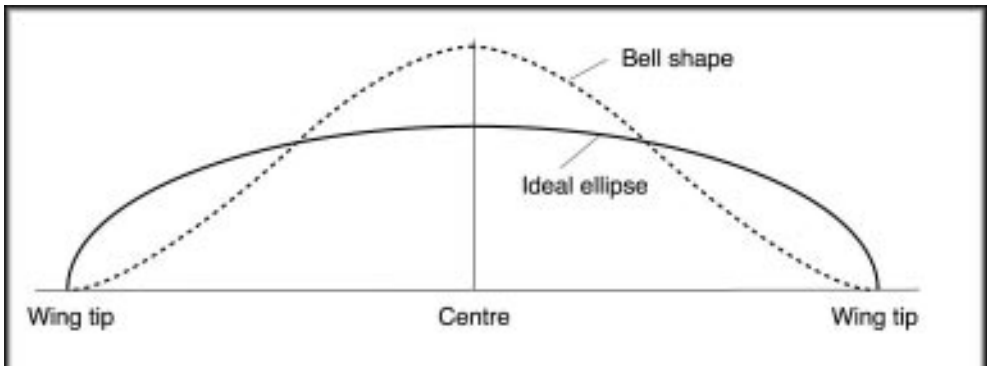

Figure 2 The 'bell-shaped' lift distribution curve compared with the ideal elliptical lift distribution. The total area beneath each curve is equal representing the required lift for flight.

its wings more and more. I know this phenomenon and I am terrified of it." He mentioned also the fatal accident to the Horten IVB, caused by wing flutter. The H IVB had wing profiles copied from the P - 51 Mustang. The fighter's wing section, unsurprisingly, did not prove suitable for a sailplane but flutter is not caused simply by the type of wing profile. Swept back wings with a degree of torsional flexibility, are always prone to this. The Hortens used the orthodox materials of their time, mostly pine for spars and ribs, birch plywood for the wing leading edge skins and fabric covering for open frame behind the main spars of the wings. Torsional stability was not very good, despite the use of light alloys for the extreme wing tips. Other pilots experience flutter at lower airspeeds.

The Bell - shaped Lift Curve

Of special importance to the Hortens was the so-called 'bell shaped' lift distribution (Figure 1).

A lift distribution curve appears if the lift developed at each station along the span of a wing is plotted on the vertical axis of a graph, where the horizontal axis represents the wing span. To compute this is a normal step in the design of any aircraft. Assuming the wing is at some positive aerodynamic angle of attack to the airflow, the maximum lift is developed at or close to the centre of the wing. The fuselage, if any, may spoil this to some extent but such interference is reduced as much as possible by careful design and fairing. At the extreme tips there is no lift so the curve there touches zero. The area under the lift distribution curve represents the supporting force. For the aircraft to sustain itself in flight, the total upward force integrated under the curve, must equal the total weight.

Vortex-induced drag

At high angles of attack, as when a sailplane is flying slowly and, perhaps, circling in a thermal, by far the most important sources of drag are the wing tip vortices. The difference in pressure between the upper and lower surfaces of the wing, causes cross flows. Powerful vortices trail away behind each tip. This creates very high drag. In slow flight, trimmed for the minimum rate of sink, the vortex-induced drag is more than all the rest put together. At the slightly faster trim required for the best glide ratio, vortex-induced drag is usually half the total. Clearly, anything that increases vortex drag has a very serious effect on the soaring ability of a sailplane, and on the best glide.

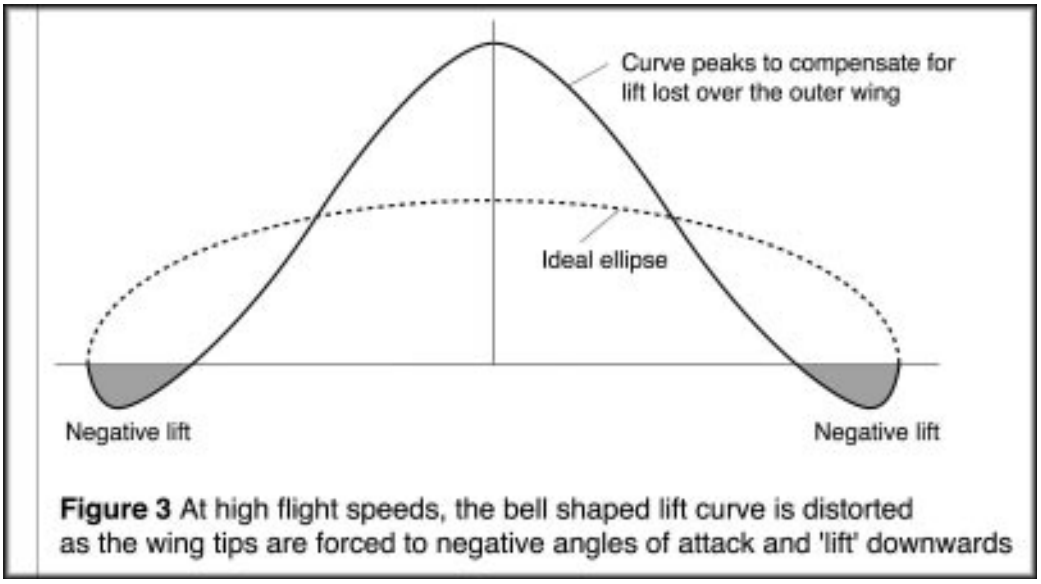

Figure 3 At high flight speeds, the bell shaped lift curve is distorted as the wing tips are forced to negative angles of attack and 'lift' downwards

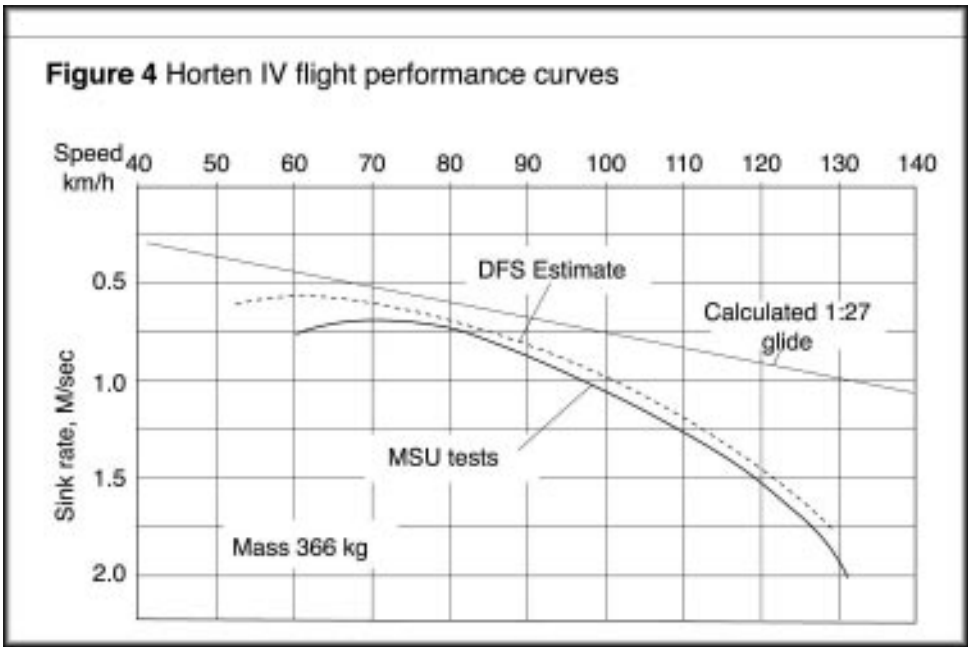

Figure 4 Horten IV flight performance curves

It has been known for a long time that a lifting wing (assuming there are no winglets) will develop least vortex-induced drag when the lift distribution curve forms a semi ellipse. If the curve departs noticeably from the elliptical form, there will be a drag penalty.

To achieve the ideal elliptical lift loading, the simplest way is to use an elliptical wing plan with no wing twist or span-wise change of angle of incidence. Most modern sailplanes approximate this closely. Each part of such a wing produces a share of the total lift in proportion to its area. No part is idle, and no part is overworked. Every bit of the wing produces drag, so it is important that every bit should also produce a proper share of the lift.

Drag penalty of the bell shape

The Horten bell-shaped lift curve departs considerably from the elliptical (Figure 2). There are, inevitably, serious

losses, particularly at low flight speeds as used for soaring. The Hortens knew this. The increase of wing vortex drag, they hoped, would be more than compensated by the saving of tail and fuselage parasitic drag. In this they were too sanguine.

The best glide ratio of the Horten IV is sometimes stated to be 1:37.[4] This was never attained in actual flight. Reimar Horten, by his own admission, made the original calculation assuming that the spanwise lift distribution of the sailplane was perfectly elliptical.[5] The 'bell shape' is far from elliptical. The 1:37 ratio emerging from this crude preliminary calculation was nevertheless published and apparently has been accepted widely ever since.[6]

There were only two attempts to measure the performance of the H IV in flight, one in Darmstadt over two or three days in May 1943, by comparison flights against the D - 30 Cirrus. (The pilots were Hans Zacher in the D - 30 and Heinz Scheidhauer in the H IV.) The Darmstadt tests, to which Zacher's remarks about precision (see above) apply, found the best glide ratio to be 1:32. The estimated polar curve published after these tests show the H IV to have been considerably inferior to the D - 30 except that the stalling speed was 10 km/h slower. The flying wing might have been able to turn more tightly. This was mainly because the Horten wing loading was lower. If the Horten had been ballasted to bring the wing loading to the same as the D - 30, the Darmstadt curves show the H IV would have been considerably worse than the Cirrus except at high flight speeds. (At which speeds the flutter problem arose.) The best glide measured was slightly less than the existing DFS Reiher of 1938.

The second attempt to measure the H IV performance was in 1959 at Mississippi State University, about which more is said below.

Penetration?

The bell-shaped lift curve, while not good for soaring, might seem to favour the fast glide when vortex drag becomes relatively less significant. What is lost in the climbs during a cross-country flight, might be made up if there is good 'penetration' between thermals.

Unfortunately this does not apply to the Horten sailplanes.

Washout

To produce the bell-shaped lift curve the Horten wings were built with a negative twist, that is, 'washout'. There was a progressive geometric change of the profile towards the tips also. The twist and change of profile were necessary to achieve the bell curve at low flight speeds, but also for balance and stability of the swept wing. The effect of the twist, however, was to force the entire shape of the lift distribution curve to change at different airspeeds.

Trimmed nose-down to reduce the angle of attack and fly fast, the outer parts of a 'washed out' wing are compelled to operate at negative angles of attack.[7] The lift distribution curve then shows negative or downward 'lift' over the outer panels. At moderate airspeeds, the Horten 'bell' acquires an upturned rim.

New tip vortices develop, rotating in the reverse direction. These do not cancel out any of the vortex drag from the normal lift-induced effect. The total lift from the inner wing still must support the total weight. The tip download compels the inner parts of the wing to work even harder to counteract the downward force from the washed out tips. So the total vortex effect inboard is more, with greater drag. To this the new tip vortices drag must be added. Far from producing their proper share of supporting force, the outer wings push the glider down.

All this about washout applied to ordinary sailplanes with washout. Most of the older 'vintage' sailplanes, like the Rhoenadler, Petrel, Olympia and Weihe, had pronounced washout and hence they, too, had more or less bell shaped lift curves at low flight speeds. But at high airspeeds the pilot can see from the cockpit that the tips begin to bend down. The total integrated area under the lift curve, taking in both positive and negative, must still support the weight. The inner part of the lift curve is forced to a higher peak to compensate for the negative contribution of the washout (Figure 3). The elliptical wing with no twist, does not suffer in this way.

Adverse yaw

Why, then, did the Hortens use the bell shaped lift curve? Their main reason was not to improve the performance but to improve control in yaw. The sailplanes had no vertical fins and no orthodox rudders (let alone winglets), to save the drag of these parasitic items. It seems to have been a matter of firm principle to them, that nothing should be added to the pure wing. It was theorised that, with the outer wings producing little or no lift because of the bell curve, deflection of the ailerons would not result in the adverse yawing experienced with orthodox sailplanes. There would then be no need for a fin or fins. Unfortunately this proved to be mistaken.

Karl Nickel wrote, "Any pilot who ever flew a Horten aircraft knows that this aim has not been attained. Unfortunately all Horten flying wings possessed an adverse yaw moment, which for some of them has been very disturbing."[8]

Aileron drag

A brief discussion of aileron drag is necessary. Adverse yaw is experienced at the moment when the pilot wants to enter, or come out of, a turn. To turn efficiently an aircraft has to bank, directing a proportion of the lift force to one side. Ailerons roll an aircraft by creating an imbalance of the span-wise lift distribution. One wing produces less lift, the other more, so the aircraft rolls. Unfortunately, because of the difference in strength of the two tip vortices, there is a difference in drag and the aircraft tends to yaw away from the desired turn. If not corrected at once, an ugly sideslip results. With sailplanes, having relatively very long wings, the effect is much more pronounced than on most powered aircraft. To enter a turn cleanly, some means of preventing adverse yaw must be found.

At the desired angle of bank, determining the rate of turn, the pilot checks the roll and, to maintain the turn, in a sailplane usually has to 'hold off' bank a little with the ailerons held slightly against the turn.

To come out of the turn, the ailerons are applied to create the necessary

imbalance of lift, there is aileron drag and adverse yaw at this moment, but it disappears once straight flight is resumed with ailerons central and the tip vortices return to equality.

To emphasise all this, adverse aileron drag is inescapable. The lift imbalance weakens the tip vortex on one side while increasing the vortex on the other. Accordingly, drag on the wing with aileron up decreases while that on the other wing increases. This inequality tends to yaw the aircraft away from the desired turn. *Whatever the shape of the basic lift distribution curve, moving the ailerons produces unequal tip vortices.*

The bell shaped lift curve does not change this. The absence of any kind of vertical stabiliser on the Horten sailplanes compelled the pilot always to use the wing tip drag spoiler rudders against the yaw. The additional drag of the spoiler rudders was certainly not less than the drag of an ordinary rudder on a vertical tail. Nickel concluded: "The use of the 'bell shaped' lift distribution to avoid or to reduce adverse yaw is inappropriate!"

Summing up

All in all, it is not very surprising that the Horten flying wings had difficult handling characteristics. Walter Horten admitted this. Pilots must get used to it, he said. Some pilots did, yet the 'wings' did not perform as well as had been hoped. Reflexed profiles sacrifice efficiency for the sake of balance, swept back, slender wooden wings tend to flutter, the bell - shaped lift curve creates extra vortex drag at low flight speeds when vortex drag is dominant already. Washout distorts the lift distribution even further at high speeds.

This brings us to the tests carried out by August Raspet's group at Mississippi State University in 1959. These were reported in detail to the OSTIV Congress at Cologne in 1960. The paper presented to OSTIV remains available and merits careful study. Rudi Opitz, a very good contest soaring pilot who had some success flying the H IV in soaring competitions in the USA, assisted the MSU, trained the pilots and remained available to advise the group.

Compared with a few comparative flights in 1943, the MSU results were the outcome of a long series of carefully measured flights supported by detailed theoretical analysis of the results. There were wool tuft tests of the airflow at different airspeeds, drag coefficients were measured at five separate stations along the wing, control deflections were recorded. Great care was taken throughout.

No important changes were made to the Horten sailplane or its control linkages before these tests. They were apparently just as the experienced Opitz had set them for his contest flying. A fairing was added to the exposed nose skid. Preliminary flights revealed airflow separation over the centre section of the wing, indicating that some break down of the lift there was already a problem, with additional drag arising. An attempt was made to cure this by changing the shape slightly and sealing the shell covering the semi-prone pilot position. There is no way these changes could have reduced the performance. On the contrary, they would have enhanced it.

The measured performance of the flying wing was considerably poorer than the MSU team had anticipated.

A best glide ratio of 1:29.5 was found, with a minimum rate of sink of 0.7 m/sec against 0.55 m/s for the Darmstadt estimate. MSU at that time led the world in performance testing. No claims were made that were not well supported by factual evidence.

There may, as the MSU paper indicated, have been some other differences between the Horten IV tested in 1943, and the one flown sixteen years later. The centre of gravity, for example, may have been in a slightly different position. It could not have been much different for the sailplane would not have been controllable at all if it had been shifted very far. Variations of the pilot weight would not have changed the balance point much in any case.

At the end of the OSTIV paper, a programme was suggested whereby the H IV, or a derivative of it, might be developed to the point where a best glide ratio of 1:50 could be obtained.

The death of August Raspet in an aeroplane accident soon after the completion of the tests, rendered this further work impossible at MSU. Perhaps, if a new Horten IV is built now, there will be a future for it based on the MSU recommendations.

References:

1 Eric M Brown, *Wings of the Weird and Wonderful Vol. 1* Airlife, 1983, p 145 - 9.

2 Hans Zacher, quoted by Karl Nickel and Michael Wohlfahrt, *Tailless Aircraft in Theory and Practice*, AIAA, 1994, pp 26 - 8.

3 The centre of pressure, however, is an abstraction, a result of mathematical calculation and not directly measurable. It is preferable to say that correctly designed reflexed profiles have zero or positive pitching moment measured about the aerodynamic centre, which is at approximately the quarter chord position.

4 R Horten & P Selinger, *Nurflügel*, H Weisshaupt 1983 p 108.

5 Nickel, op cit, p 442.

6 The figure is tabulated with other leading data on page 108 of *Nurflügel*, but only five pages earlier the test results and the resulting polar curve estimates are also shown, demonstrating the exaggeration.

7 This applied also to those sailplanes which had marked wing washout, such as the old Rhoenadler and Slingsby Petrel. In a sense, these also had 'bell shaped' lift curves. See the author's previous article on washout, available from VGC Sales.

8 Nickel, P 443 - 4.

■

My Golden Retriever

Dick McDonald
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Dick is a member of the Seattle Area Soaring Society and has spent quite a bit of time designing, building, and operating an auto-retriever for use when a winchmaster is not readily available. Since all of the photos are in black and white, we need to tell you at the outset that Dick applied gold paint to his retriever.

(left) Closeup view of the spindle when the bale is in the up position. Everything is shaped to prevent snags.

When I was a kid I always wanted a Golden Retriever. Well now I finally have one. I will admit it's not quite the same, but it will retrieve my parachute and winch line every time I launch and all I need to feed it is a little twelve volt DC.

Here's how it works:

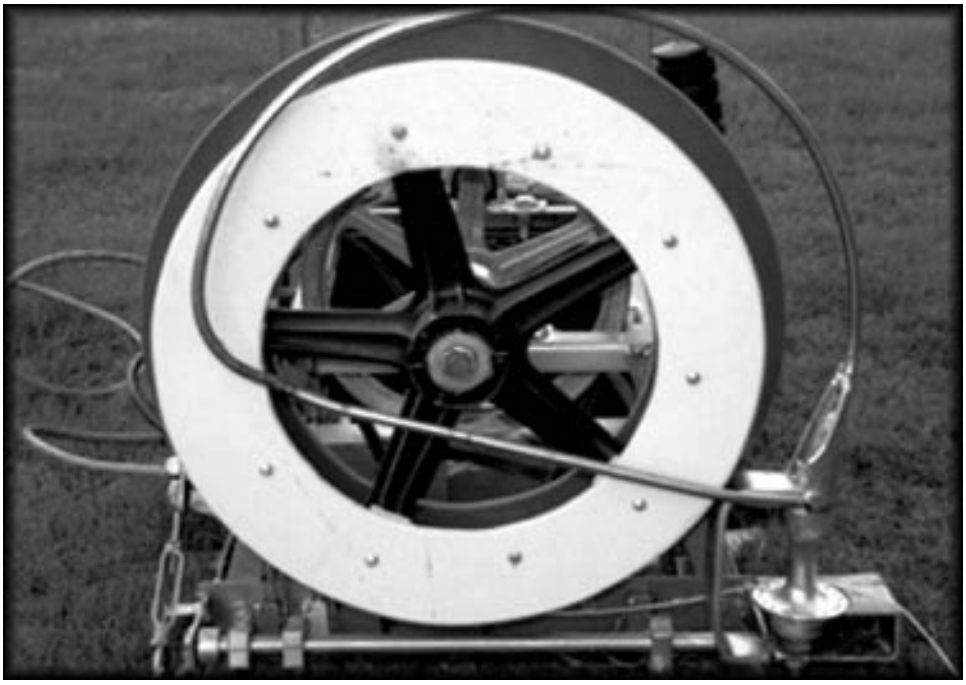
- You hook the line and parachute to your plane, then step on the double pedal board with your heel. This closes the contacts on the lower switch pedal thus completing the circuit to the windshield wiper motor, swinging the bale to the ground. When the bale gets to the ground an adjustable spring arm makes contact with a micro switch opening the circuit and stopping the motor.

- Now if you have checked your plane and all functions are working, you move the switch on the switch post to the "on" position and you can start using the winch pedal as you normally would.

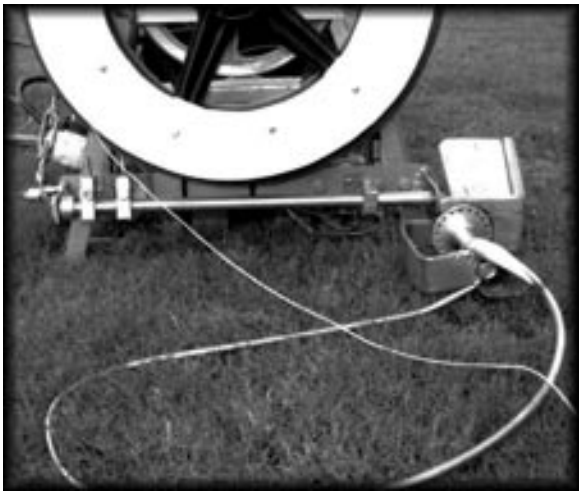
- When your plane comes off the line, you immediately step completely off the double pedal switch and level out your airplane. When you step off the lower pedal switch

(Right) Closeup of one of the microswitch actuators. The bolt holds the two halves together and allows adjustment of timing and pressure on the switch toggle.

(Below) With the bail down, the bicycle hub spindle is easily accessible. The flange of the bicycle hub spindle is recessed into the bracket so the tow line can't get caught.

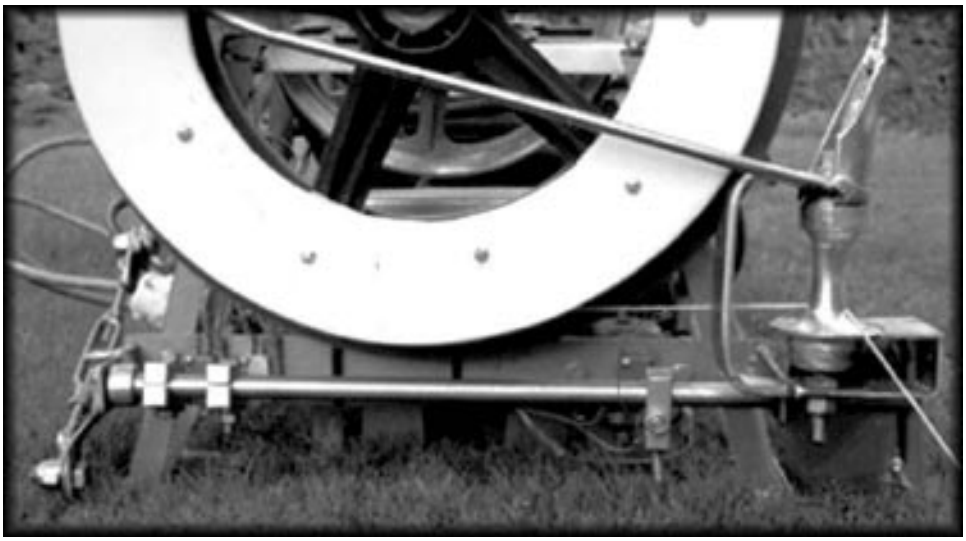


The face of the retriever, bale up and ready for retrieving the line.



(left) The face of the retriever, bale down. Note the two micro switch actuators on the left (retriever start and bale kill UP) have rotated away from their respective switches, while the actuator on the right (bale kill DOWN) is pressing against the switch toggle.

(Below) The lower part of the face of the retriever, bale up. Note the two microswitch actuators on the left (retriever start and bale kill UP) are pressing against their respective micro switches, activating them. The actuator on the right (bale kill DOWN) has rotated downward and so it is no longer actuating its switch.



the circuit to the windshield wiper motor is completed, the bale comes back up and with it the tow line. The two adjustable arms on the bale shaft will come in contact with two micro switches. One switch will open, stopping the windshield wiper motor. The other switch will close and start the motor of the retriever.

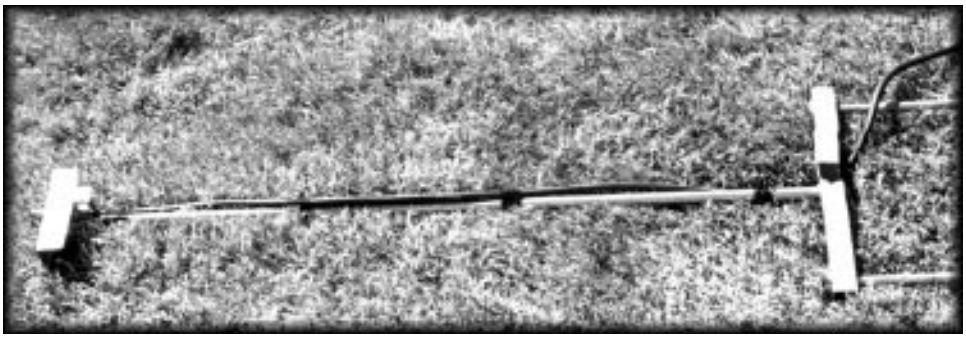
- At this point you have a choice, assuming your plane is leveled out and flying OK. You can glance down and shut the post switch off just before the parachute gets to the wicket. Or you can listen to the retriever motor and as it starts pulling on the winch motor you know the line is tight so you can shut it off without looking down. When you are ready to winch up again you can turn the pole switch back on and finish retrieving the parachute.

You can launch at any time without having to find someone to run the retriever.

It's great fun to have a golden retriever and I don't have to take it for a walk on a cold, rainy night!

_____

Dick brought a new golden retriever to the January SASS meeting. This one is designed for use during contests and "club nights" at 60 Acres. The bale drops when an electric automobile door lock is actuated by the first switch in the double pedal. When the launch is completed, the bale is lifted manually and the retriever is activated by a handheld switch. There's no windshield wiper motor lowering and raising the bale. Two fail-safe devices have been added: the winch motor cannot be operated until the bale is fully dropped, and the retriever motor will not run unless the bale is fully up. Training winchmasters on this retriever is a breeze, and the fail-safe mechanisms dramatically improve safety and eliminate those common errors which cause downtime.

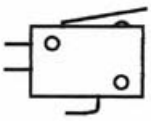


(Top) Dick ready to launch. The bale is down so the retriever line can feed out when the winch motor is started. The retriever switch is mounted on the pole to Dick's left.

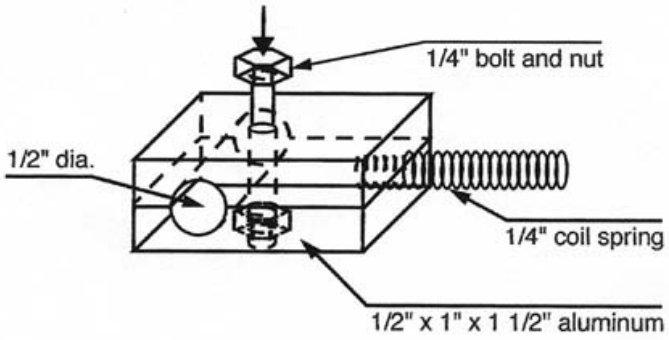
The post switch lying on the ground. One man launch and retrieve is possible when the switch pole is firmly planted in the ground next to the launcher.

Golden Retriever
Basic Parts List:

3 — micro switches, Cherry brand
1 — toggle switch, 10 amps, 1/2 HP, 125/250 VAC
1/2" dia. steel rod (shaft)*
1/3" dia. steel rod (bale)*
1/8" x 1 1/2" flat steel bar*
* lengths are left blank because your retriever will be specific to your design
3 — 1/4" coil springs
3 — 1/2" x 1" x 1 1/2" aluminum cut from flat bar
1 — windshield wiper motor from wrecking yard, may have many wires, so ask how to hook up
1 — 1/4" turnbuckle
2 — foot switches
1 — door hinge for pedal
wire 2-16 gauge with ground for connections between pedal and pole switch to retriever
plywood for pedal
wire 16 gauge, single insulated for switches
wire "clamp on" ends
2 — 3-wire receptacles
2 — 3-wire plugs
1 — 1/4" phone jack plug and receptacle
miscellaneous bolts and nuts



Sketch of Cherry brand micro switch.

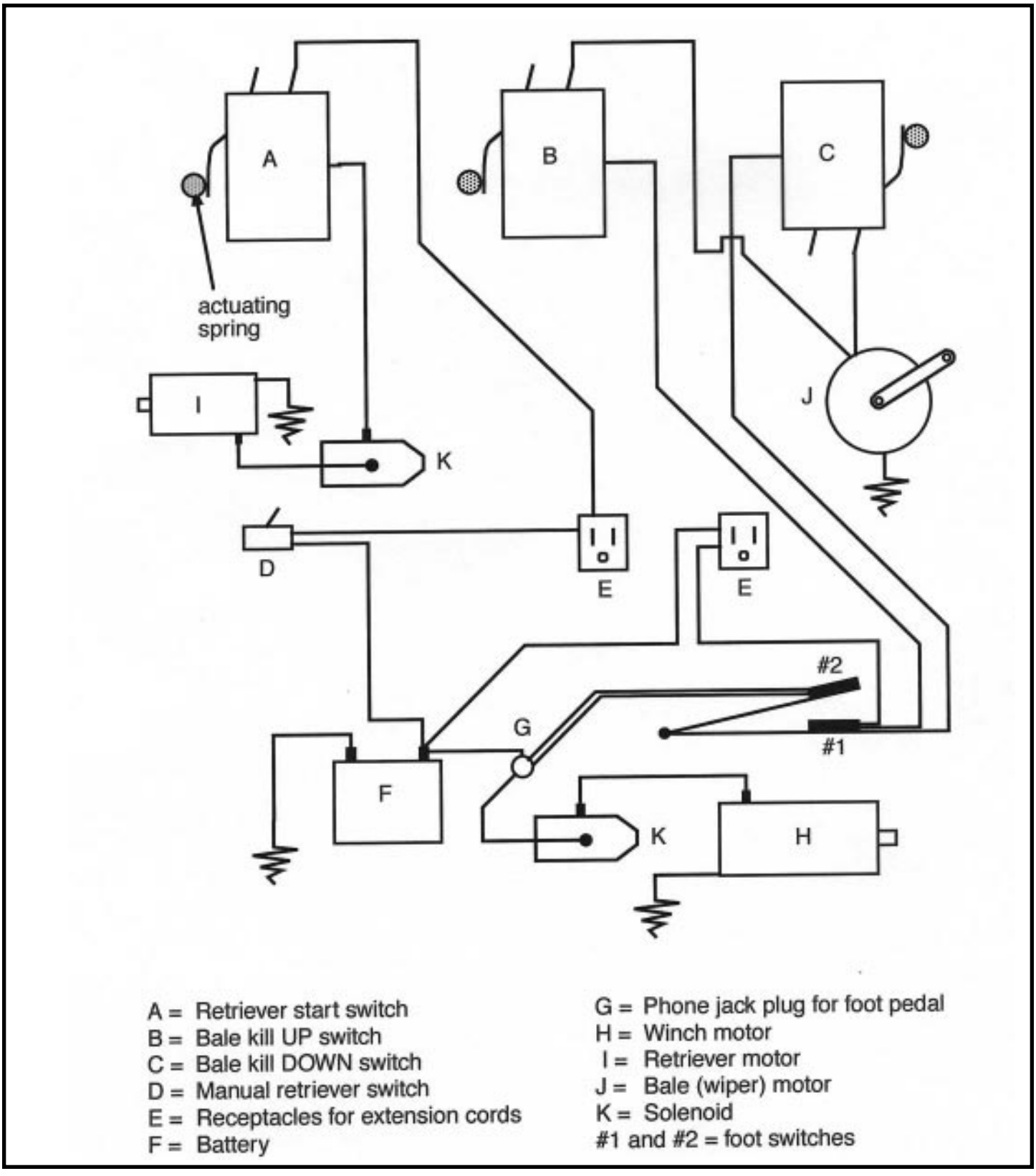


Micro switch actuator.

Suggestions:

Depending upon which windshield wiper motor you get, it is a good idea to make a mock-up of the arms on the wiper motor and bale and their pivot points out of cardboard. The dimensions must be very close in order to have a full revolution on the wiper motor and only the swing down and up on the bale. The turnbuckle is for fine adjustment to get the line to load where you want it on the takeup wheel.

The adjustable aluminum blocks each hold a spring which operates a micro switch. These blocks are best made by drilling the necessary holes, then sawing the block lengthwise. This will give the necessary clearance so it will clamp both the rotating shaft and the spring.



HAVE SAILPLANE, WILL TRAVEL!

By Tom H. Nagel
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The Ronnie Winch

Ronnie Woodyard is an individual ist. He hunts deer with a bow, fishes with a fly rod, and flies RC scale sailplanes off a slope when he can, and off a winch when he has to. A while back he bought an Omega HLG, V-tail with ailerons, for some light sloping and hand launch.

Although Ronnie is a pretty energetic guy, he soon tired of javelin launching the Omega at our flat field. He decided that what he really wanted was a winch, something he could easily haul around and that wouldn't cost a bundle. After a little thought, some scrounging in his junk boxes, and a couple of hours of work, Ronnie showed up at our field with the Ronnie Winch.

The key breakthrough came when Ronnie realized that the 12 volt hand held starter motors for gas powered model planes were plenty powerful enough to winch a HLG. He bought the smallest one he could find, a Hobbico 40. These starter tools have a built in switch that the user activates by squeezing the body of the starter. Ronnie bolted the starter to a piece of ply, about a foot wide and 18" long. An old front landing gear strut from a trainer became the foot pedal. An aluminum reel from a fly fishing outfit became the spool.

Ronnie loaded the spool with 40 pound "Walmart Special" monofilament. A used toothbrush jammed into a hole in the plywood base became the brake for the spool. Ronnie bent another leftover piece of power plane landing gear wire into a front line guide. Power is supplied by a 12 volt motorcycle battery.

The 5" pocket comb in the picture is for scale. This is one tiny winch. Not only is it easy to carry around, you could probably shove it under the front seat in your mini-van.

Even the turnaround is simple: Ronnie went to the hardware store and bought a gutter spike and a welded stainless steel ring. He tied the ring to the gutter spike with some braided nylon cord, and the ring-tied-to-a-gutter-spike serves as the turnaround.

The Ronnie Winch doesn't even get spiked into the ground. Ronnie originally made provision for spiking down the plywood pad, drilling some holes for gutter spikes, but soon found that just the weight of his foot was enough

This column is dedicated to soaring vacations. If you have a favorite sailplane saga, consider writing it down for *RCSD*. If you are planning a vacation that includes your plane and transmitter, consider making notes as you go, and working up an article later. Take photos. Collect maps. And send your story to Tom Nagel at tomnagel@iwaynet.net for gentle editing and suggestions.

Tom

to keep the winch in place while launching.

Ronnie winch launches of the HLG Omega look like miniature versions of an open class sailplane being winched by the typical Ford long shaft starter motor winch. Ronnie can even get a little zoom off the top. Launch heights are hard to estimate, but the HLG at the end of the launch looks like an open class sailplane at the end of its launch.

Experiments with a 2 meter sailplane are in the works.

Ronnie has plans to try a slightly bigger version of the Ronnie Winch for his bigger scale planes, using a larger version of the starter motor.

And, at the urging of another club member, or maybe his dentist, Ronnie recently replaced the toothbrush brake with a more typical drum brake.

If this article inspires you to experiment, please let me know. I'll pass your results along to Ronnie. ■

R/C Soaring Digest

Radio controlled

THE JOURNAL FOR R/C SOARING ENTHUSIASTS

A MONTHLY LOOK INTO THE WORLD OF SAILPLANE ENTHUSIASTS EVERYWHERE

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RCSD encourages new ideas, thereby creating a forum where modelers can exchange concepts and share findings, from theory to practical application. Article topics include design and construction of RC sailplanes, kit reviews, airfoil data, sources of hard to find items, and discussions of various flying techniques, to name just a few. Photos and illustrations are always in abundance.

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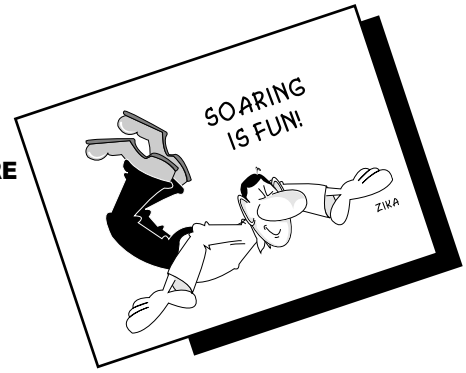

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Getting a Charge Out of Your Batteries

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If you're anything like me, it's about time to think about getting your planes in shape for the flying season. Maybe they've been left on the shelf since the last outing in November. Maybe you're putting together a new plane for this year. Maybe you're upgrading some of your electronics.

But have you paid much attention to the electronic heart that makes it all work your batteries? Whether they are in your flight pack, transmitter, field charger, stopwatch, etc., nothing works unless these guys do.

If you resemble my slovenly ways even a little bit, you've probably neglected them for a few months. You might have even left the transmitter or receiver on since your last outing and now they're dead as a hammer!

To prepare for nicer weather, let's spend a few minutes talking about batteries and maintenance. First, let's put things in perspective just a bit. What about the cost/benefit ratio of batteries in your system?

That's pretty easy. What's your plane cost? Not just the plane, but the servos, receiver, linkage, and the many hours you spent either finishing it or setting it up for flight. My guess is you're looking at anywhere from 500 to 1500 bucks.

What's a flight pack cost? For a 500maH 4-cell pack, you're looking at ~ $20. For an 8 cell transmitter pack, maybe ~ $40. If there's ANY question about the health of your batteries, is it really worth risking that much of your R/C equipment on 5% or less of your investment?

I don't think so!

Let's run through a checklist of things to do to get ready for this season.

Let's start very simply - have you checked out your stopwatch lately? How many years has it been since you changed the battery? Does it work reliably all the time? Even if it runs OK, the contacts might be corroded.

Pop off the battery cover and take out the battery (or batteries), Most watches use either alkaline, silver oxide or lithium type batteries. Just about any kind of battery that you need can be found at a camera counter in any large department store. Radio Shack carries a lot of different batteries also.

While you've got that battery out, check the contacts. If the battery has been in there for more than a year or so, the contacts may show some corrosion. If so, you may be able to clean it up with a pencil eraser. It it's seriously corroded, knock off the big pieces with a pin and then smooth the surface with a jeweler's file or emery board.

If you have to use abrasion then you've likely lost the plating on the surface (looks a bit brassy rather than chrome shiny). This will continue to corrode with time but can be inhibited by putting a light coat of Vaseline on the contacts. Make sure there's enough spring force in the contacts for a good battery connection. The Vaseline won't interfere with the connection but it will reduce the oxidation rate of the contacts. You might get another couple of years out of your stopwatch this way.

Let's take a look at your receiver and transmitter battery packs. At this point, you're going to start needing some battery cycling and analyzing equipment. Maybe something neat like this showed up for Christmas? The trickle chargers that come with your radio are OK for routine use but we need some industrial strength work here.

A rapid charger is a really handy item. A number of them are available on the market but I prefer the Sirius brand. These are peak detect chargers that sense when your battery is fully charged and go over into maintenance mode when they get to that point. Another nice feature is they run on 12 Volts so they can be used at the field with either your car or a field battery.

You also need something to analyze the battery capacity. I use an FMA Einstein unit but there are other boxes from FMA, Hitec, Hobby Lobby, etc. These devices do a controlled discharge of your batteries and measure how much charge was stored.

Batteries are typically rated in Amp-Hours or milliamp-Hours. A typical receiver pack, for instance, is rated around 500 mAH. That means the pack

can deliver 500mA of current for an hour, or 250 mA for 2 hours or, etc., etc. However, nickel-cadmium batteries can exhibit memory, reverse charging and other problems (nickel metal hydride batteries can have other problems but they're not as common yet for our usual applications).

Memory occurs when a battery is discharged to about the same level over many uses. Then one day you need to get the rest of the juice out of it and it just can't do it. It looks like a dead battery but it isn't.

Battery analyzers take care of this problem by first discharging your battery to a low (but safe) level before initiating the charge sequence. After a few cycles like this, memory is usually wiped out.

The other problem you can have with long-term storage of NiCd batteries is the occasional tendency of one cell in the pack to drop low in voltage, which may allow the others to pump what they've left got into the weak battery. This is a reverse charge and may result in (or from) an internal short in the weak battery. If this happens, the other cells may be damaged from the heat they build up during rapid discharging through their dying buddy.

If you've left your equipment on for a long time, and the battery appears to be REALLY dead, it's likely that something like this has happened. A way to check out the health of your system is to run the pack through 3 or 4 charge and discharge cycles. If the full capacity of the pack doesn't come back by then, toss the pack and get a new one.

If you know what you're doing, you can break open the pack, find the weak or dead cell and keep the rest for other uses. Be careful if you do this because the other cells may still be carrying a full charge and it gets real entertaining when you get a metal tool or soldering iron across those contacts.

If you use a field box with a gel cell battery, it's time to check that out as well. A typical field pack may have a 12V gel type battery rated for about 7AH. These units will have the same general characteristics as a lead acid battery. Our hobby chargers aren't set up to service these batteries but visual inspections for leaks, corrosion and poor contacts are in order.

When these guys fail they usually quit all at once. Or they exhibit unexpectedly short lifetimes and won't hold a decent charge. On rare occasions, they start leaking their corrosive innards all over your floor or workbench. Please be careful cleaning up if this happens as the battery fluid is quite acidic. Use latex gloves and lots of water to dilute the mess. If any of these symptoms occur, it's time to change out your gel cell as well.

Several other items to look over especially for the 2M and open class ships are the connectors to your servos. Normally the ones in the fuselage don't see much wear and tear. It's a good idea to pop them out at this time of year, check for any corrosion or loose contacts and then re-assemble and be sure they're working OK.

The guys that really get beat up, however, are the wing connectors. You connect and disconnect them each time you go flying. When you're in a hurry to get home from the field you may give an extra hard pull on a particularly reluctant plug. If so, you've put a lot of strain on the wire and/or solder joint. Now is a good time to check for loose wires or bad connections. Tug, wiggle and bounce the connector around some to see if you have an intermittent contact. Inspect the contacts for corrosion and clean with an eraser or contact cleaner. Re-solder any bad wires or replace the connector. Think about how much that connector costs versus how much the plane is going to cost if you lose control on that wing!

From the tiniest park flyer to the biggest Open class ship, we rely on our batteries and connectors to make things work. A little maintenance now will pay big dividends later. And if there are any questions about the condition of a pack or a connector, your first decision should be to toss it and get a new one. You've got a LOT riding on those cells. Make sure they're up to the job!

■

TIPS FOR THE FINE TUNING OF F3J MODELS

By Stefan Eder

Translated for *RCSD* by
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Stefan Eder, one of the top pilots in the German National F3J Team, designer, test pilot, and regular author in several model magazines, has written the following article. It should be clear that it is not the intention to describe the general adjustment of a glider for Sunday flying; this is about the last touch in the setup of competition models, whereby it should be understood that sometimes it's a matter of some tenths of a millimetre! Nevertheless, each pilot may hopefully find something interesting and improve on his models' characteristics. So here we go:

The adjustment and fine tuning of modern F3J and F3B models has evolved almost in a science in itself, and is directly responsible for the flying characteristics, and certainly performance. With the aerodynamically refined models of today, the performance is greatly influenced by tiny gradations, and many a disappointment over a model is often due to very small inaccuracies or adjustment errors. However, a general guide is practically impossible because, in the end, the final adjustments will depend largely on the personal taste and preferences of the pilot. When several pilots are asked where their favoured center of gravity (CG) is situated on a particular model, their answers show remarkable differences. And since, with the CG, also the angle of incidence (AoI) has to be modified – especially with gliders with V-tails – it is very difficult to determine an 'ideal' AoI, be it wing or stabilizer. Don't adopt blindly the CG nor the AoI as given by the manufacturer or supplier, but test fly your ideal adjustments yourself. The indicated values are useful as a starting base, and can be adjusted later to your individual liking. An example: when testing the Starlight 2000, serious problems were caused by the AoI; the V-tail AoI - fixed by the mold - proved clearly to be exaggerated, so that in the end the leading edge of the tail had to be raised by 1,5 mm. Now, the following

method has functioned very well for my models and my way of flying.

A. CG and AoI

As a start, the model is balanced to the CG as indicated by the supplier. On the flying field, the CG is tested before the first winch or high start; the reputed first flight 'on a slope with tall grass and little or no wind' is often wishful thinking, but running with the glider held above your head and releasing and catching it a couple of times, will tell you enough. If the nose suddenly pulls up, some ballast will be needed in the nose; if the model drops back right away in your hand, it's ready for a first high start. The usual hand starts, with many unknown factors, can be dangerous (slow and low), and are best forgotten. After a high start, there is enough air under the wings to trim the model at ease. The often practised 'dive test' at 45° will only give a rough estimation, because the reaction of the glider is dictated by an (unreliable) elevator trim. The final and exact CG may be found only after many flights, and after many weeks of testing in very variable weather and wind conditions. When circling (e.g., in a thermal), one observation may be that the glider wants to increase the bank; it's a sign that the model is tail heavy and needs ballast in the nose – and an adjustment of the AoI (= increase)! On the other hand, slow reactions and an unsatisfactory gliding angle indicate a nose heavy plane. If the model starts a porpoising pattern (= up and down) while soaring quietly straight on, some ballast should be removed from the nose; by bringing the CG back and decreasing the AoI, the gliding angle as well as the speed of reaction are usually improved, and the behaviour will be more neutral. The last 5 or 10 grams of ballast are given or removed, if necessary, by watching the model when it's circling; if it has a tendency to narrow the circle (= to 'center'), very small amounts of ballast may be removed (and again, adapting the AoI accordingly), until the desired stable pattern has been achieved (*). On the contrary, if the glider is reluctant to enter the turn and wants to stick its nose to the 'outside', an aft CG and too small an AoI are most probably the cause. Now, if you prefer to flirt with an aft CG, and a stiff breeze causes turbulent conditions, 5 or 10 grams of nose ballast will improve stability.

B. Adjustments of the Control Travel Limits

One should resist the temptation to use the many mixing possibilities of your computer transmitter from the very beginning. It is preferable to adjust each axis of the model separately.

The effectiveness of the up-elevator travel limit will be made clear when circling in a thermal, and should be set up in such a way that sharp turns can be continued without tendency to stall. Down-elevator is less critical; the throw should be sufficient to bring the nose quickly down after a 'ping' release. Normal aileron differential (more up than down) will be to a 3:1 or 2:1 ratio; when quick successions of 45° turns are made, from one side to the other, the model must react immediately by pointing its nose in the desired direction without any signs of skidding, and maintain a horizontal flight level. Aileron travel should not be set up as if it were for an aerobatic 'plane – this is undesirable for a F3J glider, because the dihedral is set up for thermal circling. If a V-tail is fitted, the rudder differential (i.e., not the elevator function!) must be carefully tested. First, trim the model for normal gliding in a straight line, and see how it reacts when only rudder is given. If it slows down noticeably and lifts its nose even slightly, the throw 'down' must be increased. If the nose drops visibly, increase 'up' until the nose stays horizontal, or drops very little. If you like to mix rudder with ailerons, then mix just enough until absolutely true turns are achieved without any negative twisting moment, while steering only with the ailerons.

With a butterfly (crow) setup, the relation of ailerons-to-flaps is important; the best effect is obtained with the flaps as far down as possible, in combination with only a moderate 'up' aileron; so there will be still enough aileron throw available for abrupt course changes while aiming for the spot. With modern computer transmitters (such as the MC20, 22 and 24) it is possible to reduce automatically the aileron differentiation when butterfly is deployed, so that full steering and reaction remain active.

(*) Translator note:

Please note that some confusion may occur by reading that '…the model has a tendency to make the circle smaller', so *less* nose ballast, while on the other hand, an earlier paragraph says '…it will narrow the circle', so a bit *more* ballast. The difference relates to the movement along the transversal (cross) axis; in the case of 'more ballast needed', the model will not only fly a rather irregular circle, but also shows a tendency to 'pump' (i.e., wave up and down). In the case of 'less ballast', the clear tendency is to drop the nose, what may finally result in a spiral dive.

The article 'Tips for...' by Stefan Eder has been a great help and support for most of our club pilots, whether they fly in competition or not. So, when Gregory Ciurpita in one of his recent articles in RCSD suggested that somebody should write about the more practical side of adjustment and tuning, I took this opportunity to contact him, and after some brainstorming the article of Stefan was translated in my very personal English... Greg was so kind to do the weeding, so that it's now available to everybody. Should any of you have questions, I'm sure Stefan will be pleased to answer them; kindly mail these to my e-mail address:

rrsegers@skynet.be

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SCHEDULE OF SPECIAL EVENTS

March 15-16, 2003
The Classic Mid-Winter Southern California
Torrey Pines Vintage Sailplane Regatta
http://www.agcsc.org

May 15-18, 2003
Midwest Slope Challenge Wilson Lake, KS
www.alltel.net/~mwsc

May 24-25, 2003
So. California PSS Festival Cajon Summit, CA
Brian Laird, Slope_Scale@compuserve.com
<ourworld.compuserve.com/homepages/slope_scale>

October 10-11, 2003
Texas National Tournament (TNT) Dallas, TX
www.SLNT.org

November 29-30, 2003
Tangerine Soaring Championships Orlando, FL
www.orlandobuzzards.org

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

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PARACHUTES: $12.50 (includes S&H U.S.A.) Send check or money order to Dale King, 1111 Highridge Drive, Wylie, TX 75098; (972) 475-8093.

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>.

BBS/Internet

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:

web site: www.soaringissa.org

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

T.W.I.T.T.

(The Wing Is The Thing)

T.W.I.T.T. is a non-profit organization whose membership seeks to promote the research and development of flying wings and other tailless aircraft by providing a forum for the exchange of ideas and experiences on an international basis. T.W.I.T.T. is affiliated with The Hunsaker Foundation which is dedicated to furthering education and research in a variety of disciplines. Full information package including one back issue of newsletter is $2.50 US ($3.00 foreign). Subscription rates are $20.00 (US) or $30.00 (Foreign) per year for 12 issues.

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Sailplane Homebuilders Association (SHA)

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.

SHA publishes the bi-monthly **Sailplane Builder** newsletter. Membership cost: $15 U.S. Student (3rd Class Mail), $21 U.S. Regular Membership (3rd Class Mail), $30 U.S. Regular Membership (1st Class Mail), $29 for All Other Countries (Surface Mail).

Sailplane Homebuilders Association
Dan Armstrong, Sec./Treas.
21100 Angel Street
Tehachapi, CA 93561 U.S.A.

The League of Silent Flight (LSF) is an international fraternity of RC Soaring pilots who have earned the right to become members by achieving specific goals in soaring flight. There are no dues. Once you qualify for membership you are in for life.

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P.O. Box 3028
Muncie, IN 47302-1028 U.S.A.

http://www.silentflight.org

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Soaring from the past into the future! The VSA is dedicated to the preservation and flying of vintage and classic sailplanes. Members include modelers, historians, collectors, soaring veterans, and enthusiasts from around the world. Vintage sailplane meets are held each year. The VSA publishes the quarterly BUNGEE CORD newsletter. Sample issues are $2.00. Membership is $15 per year. For more information, write to the:

Vintage Sailplane Association
1709 Baron Court
Daytona, FL 32124 USA

ESL

The Eastern Soaring League (ESL) is a confederation of Soaring Clubs, spread across the Mid-Atlantic and New England areas, committed to high-quality R/C Soaring competition.

AMA Sanctioned soaring competitions provide the basis for ESL contests. Further guidelines are continuously developed and applied in a drive to achieve the highest quality competitions possible.

Typical ESL competition weekends feature 7, or more, rounds per day with separate contests on Saturday and Sunday. Year-end champions are crowned in a two-class pilot skill structure providing competition opportunities for a large spectrum of pilots. Additionally, the ESL offers a Rookie Of The Year program for introduction of new flyers to the joys of R/C Soaring competition.

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