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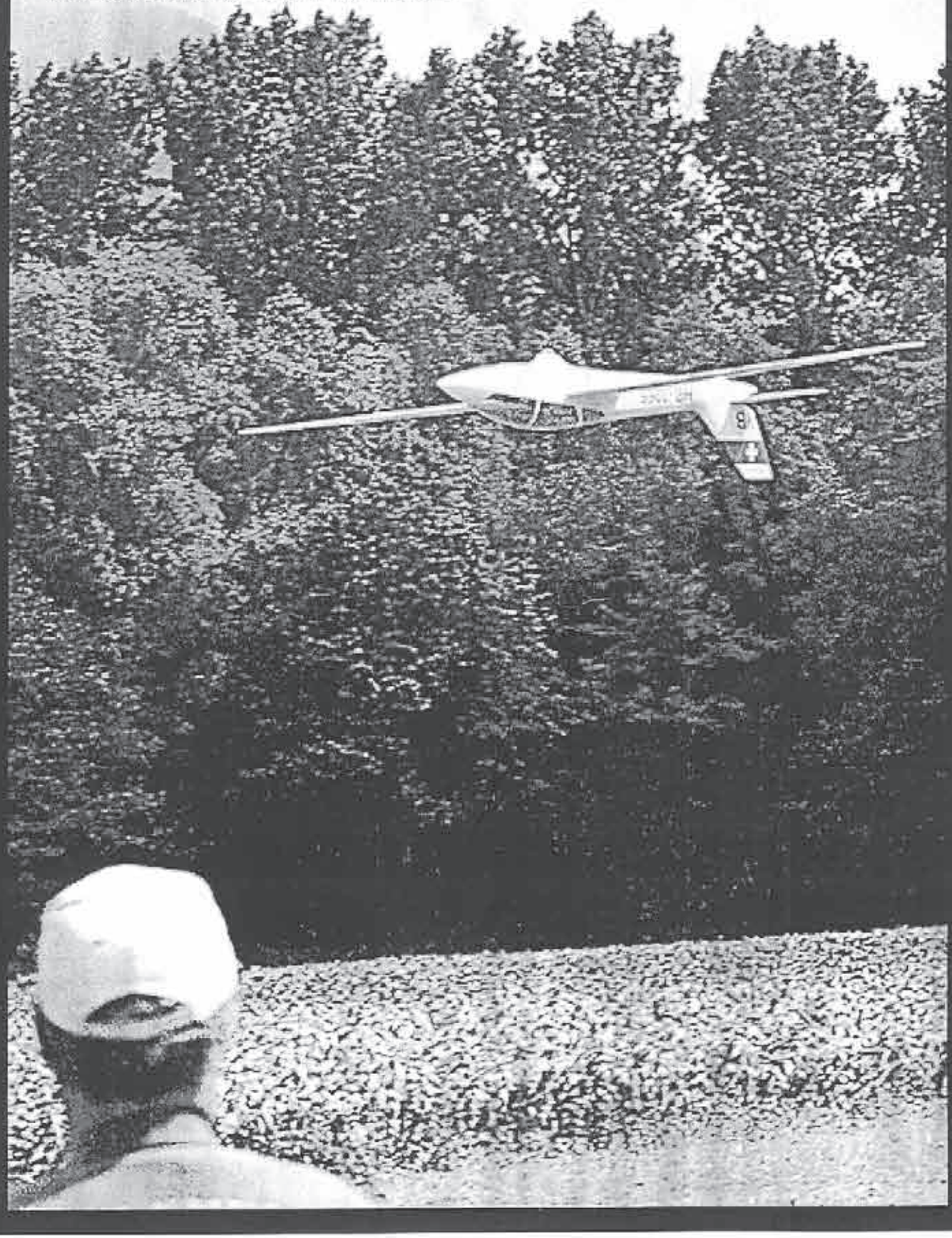
R/C Soaring Digest

THE JOURNAL FOR R/C SOARING ENTHUSIASTS



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TOWPLANES

Frisch: ¼ Wilga 109" (2,78m)
Brauer: all glass ¼.5 Pilatus Porter Turbo 139" (3.52m)
Roedelmodell: ¼ Jodel Robin 86" (2.18m)
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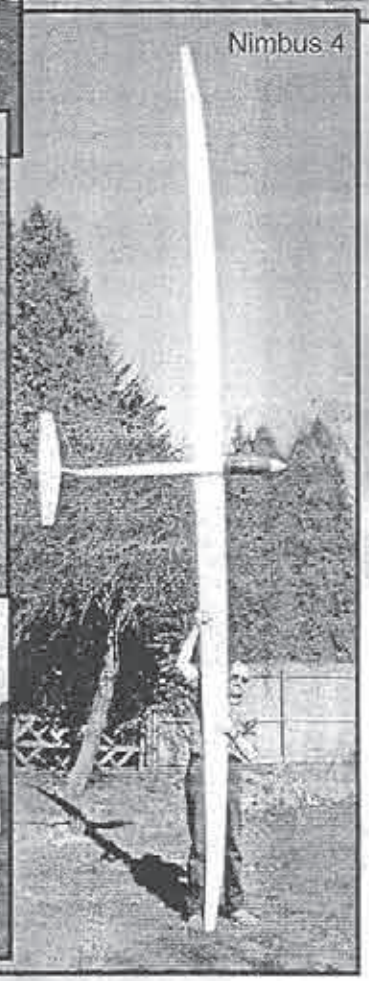
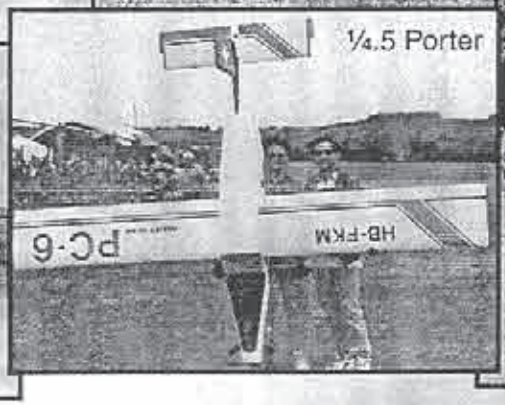
½.5 all glass	ASW15B	HQ3/14	235" (6m)





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R/C SOARING DIGEST
The Journal for R/C Soaring Enthusiasts

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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. He can be reached at: 210 East Chateau Circle, Payson, AZ 85541; (520) 474-5015, <jimpeg@netzone.com>.

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Artwork
Gene Zika is the graphic artist who designs the unique ZIKA clip art.

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OTHER GOOD STUFF

The Soaring Site

Only the Shadow Knows...

This unusual photograph was taken by Cindy Cook, Livingston, Texas. Jim Cook's shadow, cast at the San Antonio, Texas flying field, is holding an Olympic 650. Most of you will recall that Jim and Cindy like to "travel around the country looking for places to fly the friendly skies". Their write-up on a Las Vegas trip was included in the September 1997 issue of *RCSD*.

We hope everyone enjoyed their holidays; now, it's off to greet the New Year and find out what's new on the sailplane scene. With this issue, Paul Clark reports on a new design, introduced by RC handlaunch enthusiasts in Japan. And, Tom Nagel covers Bill Hoelcher's HLG Thermal Duration Record.

Happy Flying!
Judy & Jerry Slates

INVERTED FLIGHT

Yves Berkhardt (L), the driving force behind the aerobatic movement at the Stetten club in Switzerland. They held their first aerobatic contest this last summer, and it was a great success.

Photography by Jack Kagi, submitted by Robin Lehman.

Jer's Workbench

Jerry Slates
P.O. Box 2108
Wylie, TX 75098-2108
(972) 442-3910
RCSDigest@aol.com

Building from Plans...

Why build from plans? For several reasons. For example, manufacturers may have found that a particular model may not be cost effective to produce as a kit. And, in most cases one can save some money building from plans, rather than buying a complete kit. Then, there are folks that enjoy taking a stack of raw lumber, sculpting it into their personal masterpiece.

For myself, first, I have been asked to help build a built-up, polyhedral wing, that will hold up under the pull of a 12 volt contest winch. I also want to build a contest glider that will qualify for the new vintage class, being a model that was published or kitted prior to 1980. I selected the Paragon from the *RC Modeler* plans catalog, plan #626. I decided on the Paragon having piloted several over the years; I like this plane, but had never owned one before.

When selecting any plan, there are a few things to keep in mind. Some plans can be anywhere from 20 - 30 years old, if not older. Undoubtedly, some of the materials listed on the plans may not be available through a local hobby shop. So, some changes will be in order, and I don't think the designer would get upset if we made those changes and updated the plans a bit. The main thing to remember is that the plans will be used primarily to replicate the original profile or shape of the sailplane.

Having analyzed the set of plans for the Paragon, to see if any changes were required, I found that the plane could be built just as the designer had originally intended. However, being me, I just can't resist making a few minor changes. For example, the wing can be built stronger, and the rubber bands had to go. I do not like using rubber bands to hold a wing onto the fuselage, so will bolt the wing onto the fuselage, instead. Later on, I also plan to add a set of spoilers, which are not shown on the plans. I'll share those detailed changes later, as we get into the actual construction of the model.

The first step is to take inventory. Since the balsa wood supply was running low, and there were a few other items required, as well, it necessitated a quick trip to the local hobby shop. I found almost everything, except for the canopy, which I had to make myself. (For those of you new to these pages, I do vacuum forming as Viking Models, U.S.A. So, making a canopy is no big deal for me. For anyone needing help in this area, just let me know. I won't go into detail, having shared those construction techniques in earlier issues of *RCSD*.)

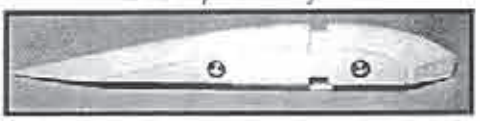
The wing is the most time consuming part of the construction; so, I began with the construction of the spars. Carbon fiber was applied to one side of the spars, and they were set aside until needed. Next, I constructed a 3/8" plywood wing joiner.

#1 - Wing joiner, spruce and carbon spars.

#2 - Getting ready to stack cut a set of ribs.

#3 - Ribs after sanded to shape.

#4 - Completed set of ribs.



#5 - Set of sanded, tapered ribs.

#6 - Completed set of tapered ribs.

Since the local hobby shop didn't have any 3/8" plywood in stock, I improvised by gluing 3 sheets of 1/8" plywood together, as shown in photo 1.

Tackling the Ribs

The ribs are probably one of the primary reasons that a lot of folks don't build from plans. The plans depict a set of patterns for each rib. Each one can be traced onto the wood and cut out one at a time... But, there's an easier way. I'm going to stack cut the ribs, instead.

As shown in photo 2, I first cut out one set of plywood ribs, stacked some balsa sheets between the ribs, and bolted the stack together. This was sanded to shape as shown in photo 3. Photo 4 shows the finished ribs; photos 5 and 6 show a set of tapered ribs. (Note: When stack cutting a set of tapered ribs, the edges will be beveled.) If you look closely at photo 5, you'll note that I left the leading edge of the ribs long. These ribs will be trimmed to fit, as I construct the wing. How long did it take me to cut the ribs? A set of 52 ribs took about 1 1/2 hours!

With the spars and ribs ready to go, I hope to have the wing completed by next month.

Paragon Plans #626
RCM Plans Service, P.O. Box 487
Sierra Madre, CA 91025

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Updates to the *RCSD* Index

By Lee Murray
Appleton, Wisconsin

The latest update to the *RCSD* Index/database has been posted on the Internet and is accessible from the *RCSD* page: http://www.halcyon.com/bsquared/RCSD.html This Index is to articles appearing in *R/C Soaring Digest*, 1984 through 1997. The ZIP file (WinZip) contains five ASCII index files: RCSD8489, RCSD9092, RCSD9394, RCSD9596, RCSD97 plus a list of keywords which will help the user search for the articles of interest. The index files can be loaded in a word processor and searched using a FIND feature. Contact Lee Murray 74727.65@compuserve.com for information about character delimited files for databases.

Examples from December 97 Issue

Vol: 14 No: 12 Dec-0-97 Pg: 21
Contributor: Christensen, Scott
Key Words: LSF
Article traces the formation of interested flyers into an organization. The people responsible for a self advancement program and later connecting...

Vol: 14 No: 12 Dec-0-97 Pg: 21
Contributor: Christensen, Scott
Key Words: LSF
[cont.] with the AMA. An excellent review of the history of RC Soaring in the USA.

Vol: 14 No: 12 Dec-0-97 Pg: 24
Contributor: Kurath, Barry
Key Words: LSF, Competition
Barry tells of his climb to Level V and the troubles and strategies used to achieve this level. Successes were sometimes quick others not so quick.

Vol: 14 No: 12 Dec-0-97 Pg: 24
Contributor: Vennerholm, John
Key Words: LSF
A description of the LSF today with membership of 7,330 including 1890 in other countries. How to get involved and what to expect.

■

Key Words

The following are key words which are used to characterize the topics of the articles in the index (Items in bold are recent additions.):

Aerial Photography
Aerobatics
Aerodynamics
Aerotowing
Ailerons
Airfoil
Autopilot
Batteries
Book Review
CA (cyanoacrylate)
CF (Carbon Fiber)
Clubs
Combat
Communications
Composites
Competition
Construction
Contests
Control
Design
Electric
Electronics
F3B
F3E
F3J
F3I
Fiberglass
Finishing
Flaperons
Flaps
Flying
Flying Sites
Flying Wings
Foam
Foamy
Forecasts
Fuselage
HLG (hand launch gliders)
Humor
Internet
Kit Review
Landing
Launching
LSF
NATS
Powered Flight
Product Release
Product Review
Radio
Sailplane
Scale
Show Review
Slope Soaring
Slope Racing
Software
Spoilers
Stability
Stabilizer
Std (standard class)
Thermalling
Training
Trimming
Turn-around
2M (two meter class)
Unl (unlimited class)
Video Review
Winch
Wing
Wingerons
Winglets
X-Country

A special thanks to Lee for 14 years of record keeping!

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By David M. Sanders
34455 Camino El Molino
Capistrano Beach, CA 92624
(714) 248-2773
davesaircraftworks@compuserve.com

New Stuff

Welcome to '98! Since it's the beginning of the year, I thought we'd take a look at some of the new stuff coming on the scene.. First, I'll list the non-scale models, then the PSS kits, then something really different from Northern Cal! I've tried to include as many of the makers as possible, but I'd love to hear from any I've missed, so you can get some exposure here, as well.

Boomerang

Frank Cavazos Model Craft
4451 Morristown Drive
Riverside, CA 92505
(909) 351-0315
mrfrank@juno.com
boomerang@Dreamsoft.com

Frank Cavazos Boomerangs. Currently one of Southern Cal's hottest new designs.

A super-light combat wing, the Boomerang is already earning a reputation as a killer in the hands of Southern Cal combat aces in its first few weeks of kit production. Construction is 2 lb. blue foam with strapping/packing tape or strapping tape/Ultracote covering. It's designed to be an inexpensive competition ship meant to be used up and then replaced. What's the benefit? Extreme light weight of only 16 ounces leaving a wing loading under 5 ounces per sq. ft. on its 479 sq. in. area. Many times, recovery from an engagement can be a function of your plane's weight, and the lighter the better, particularly in light lift conditions. The Boomerang is about as light as you can go at the moment, and serious competitors are finding it gives them a real advantage. Kits include hardware, and sell for $44.99 + $5.50 s/h (CA residents add 7.75% sales tax). Frank will also custom build the Boomerang; call for quote and scheduling.

Tsagi-GS

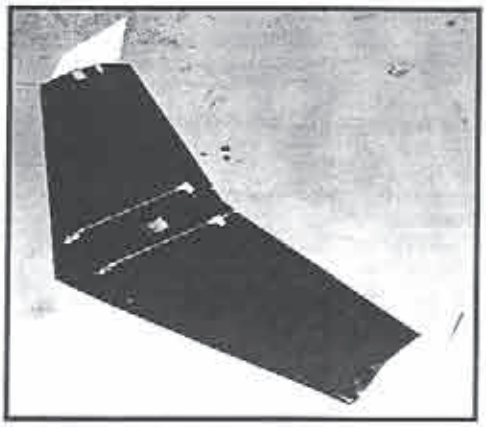
Mark Navarre
5948 Hersholt Avenue
Lakewood, CA 90712
(562) 920-2058
Gliderscum@aol.com

Tsagi-GS makes a low pass at Laguna Niguel slope. Shelby Sanders photo.

The Tsagi-GS is a 21 to 22 ounce flying wing, all EPPcombat ship of 48 1/2 inch span that is hand made to exacting specifications by SoCal combat ace MarkNavarre for competitive and sport use. The design features five carbon fiber spars to stiffen the span as well as judiciously applied strapping tape to distribute torsional loads incurred by engagements or extreme bungee launching on garden-hose size tubing.The planes come impeccably covered in two-tone colors of Goldberg Ultracote. Also included are 2mm Coroplast winglets with the distinctive GS profile (you attach them after shipment). Mark's planes are quickly gaining a reputation as the pinnacle of unlimited class combat construction technology. They come virtually ready to fly; you send Mark the onboard equipment and he returns a fully completed airframe. Price for each aircraft has currently been set at $170.00 each, plus shipping. Note; these aircraft are subject to limited availability, so be sure and check with Mark on his prices and scheduling before sending the money or your radio equipment.... He's just one man, and has a real job.

Nemesis

Steve Wilcox
1703 West Rovy Avenue
Phoenix, AZ 85015
(602) 249-6795



Nemesis 36" span EPP wing by Steve Wilcox.

The Nemesis was designed by Steve for both combat and bungee launching. I've seen it in action and can assure you, it's one heck of a bungee ship with its shorter than normal 36 inch span; its capable of intense high-energy launches without fluttering; the local combat regulars agreed it could outlaunch most if not all of today's current crop of combat ships. Of course, it's perfectly suitable for the slope, too, and exhibits the good performance of a modern combat wing. Construction is all EPP with butyl plastic winglets for low drag. Its 342 sq. in. of area carry the 20 to 23 ounce all up flying weight. Kits are $50.00 + $5.00 s/h for domestic orders; check with Steve for international shipping rates.

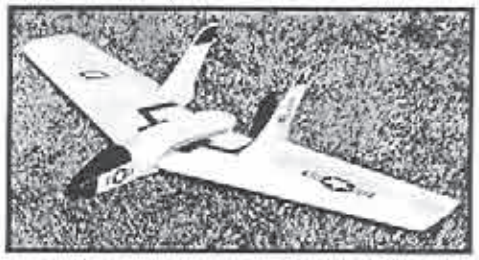
AVRO Vulcan

Aerofoam
Mark Mech
1913 East El Parque
Tempe, AZ 85282
(602) 968-6007
http://home.earthlink.net/~aerofoam/
aerofoam@earthlink.net

Aerofoam's 36 inch span, all EPP, AVRO Vulcan has proven to be a very popular kit already, as it offers a wide performance range, light weight and low cost. It's not very scale, but hey... Hard to tell at the end of a 300 foot bungee launch! Part of its appeal is an extremely light overall weight of 10 ounces (with the use of micro radio gear) on 360 sq. in. of area yielding an unbelievably light 4 ounce per sq. ft. wing loading. It has a central Coroplast fin and the kit also includes hardware. At $35.00 + $3.00 domestic shipping, it's a pretty good bargain for an all EPP airframe.

Vought F7U-3 Cutlass

Bowman's Hobbies
21069 Susan Carole Drive
Saugus, CA 91350
(805) 296-2952
fax (805) 296-9473
ruffneck1@aol.com



Bowman Hobbies EPP Vought Cutlass. Model by Pat Bowman; nice work, Pat!

Pat has given us a real beauty, this time! Not to be outdone in the foamie PSS explosion, he's brought us his new, all EPP Vought Cutlass! Spanning 48 inches, it's 100% contest legal. Area is 560 sq. in. carrying 24 ounces all-up weight for a 6 to 7 ounce per sq. ft. loading - quite good for a PSS foamie. I haven't seen this one in action yet, but am certain that it's another fine flying machine, as is the norm for Mr.Bowman. All you guys that have clamored for jets... Here they come!! Price is $69.95, and check in with Pat for shipping charges, tax, etc.

DAM P-51 B/D Mustangs

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Durable Aircraft Models Giant EPP P-51D Mustang. Model by Wade Kloos - his usual outstanding job!

EPP lives large in Wade Kloos' new all EPP, almost exact 1/7 scale P-51 B/D Mustangs! For PSS ships, this is moving into the large-size category for any construction, and Wade has gone a step further by doing it in EPP foam. They're tough like you're used too, of course, but the appearance is drop dead gorgeous. The wing planform, fuselage section and moments are true to scale within 5%. The 65 1/2 inch span is deceptive, as the plane feels much larger in your hands and has awesome presence in the air. The flight performance is smooth and groovy and all maneuvers exhibit the scale flavor that only a large plane can provide. The airfoil on the 692 sq. in. wing is a S3021 which provides a wide flyable lift range.These ships are also capable of being fitted with up to 48 ounces of ballast in addition to their 74 ounce dry weight. Un-ballasted, the wing loading is only15.4 ounces per square foot; just about right for a plane this size in moderate lift conditions. The 'D' model can also be ordered with a clear canopy (additional $10.00)! This is a truly spectacular model and a must for the hardcore foamie PSS enthusiast! Introductory price for the kits is $119.99 + $7.00 for domestic shipping. CA residents add 7.75% sales tax. Check ahead with Wade for availability and international shipping; he's just one man, new to the biz, and these kits are a lot of work for him to produce.

Me P.1111 & 2-Meter Trainer

MAD Aircraft Design
15268 Rolling Ridge Drive
Chino Hills, CA 91709
(909) 606-0363
MAD_EPP@aol.com

MAD Aircraft Design EPP Me P.1111.

I've probably had twenty people ask me, "Where can I find an EPP Messerschmitt P.1111?" Well... Mark, Andre and Dan at MAD Aircraft Design have taken up the challenge with their new, all-EPP, contest legal P.1111. The 48 inch span, 683 sq. in. wing utilizes an MH45 airfoil and 45 degree leading edge sweep to make up a 41 inch overall length. Control is by 2 1/2 inch wide elevons giving good roll response and positive pitch authority. MAD claims good recovery and superior hitting power in moderate to high lift and it's also suitable for bungee launching. Looks sharp and very scale! The complete kits retail for $59.95 + s/h and tax where applicable.

MAD is also offering a 2-Meter, all-EPP trainer design with geometry very reminiscent of traditional trainer sailplanes. Check in with the guys at MAD for their new web page address as well to keep abreast of this new company's progress.

BAE Hawk, Yak-9, F4U Corsair & Lockheed P-80

Metaterra
Bruce Schaeffer
(714) 956-2395
metaterra@aol.com

Metaterra EPP Yak-9. Model by Bruce Schaeffer.

Bruce is producing some very nice combat legal designs that offer respectable flight performance. Of particular interest is his BAE Hawk that sports the classic lines of the original British workhorse jet. A good friend of mine owns one and says he loves it at his desert flying sites. Also, there's more Red Star EPP in the form of his very slick Yak-9 model. This one is also combat legal with a 48 inch span and hard stuff in the right places. The example I was shown sported clear covering to save weight on the all-white finish and came in at an amazingly light (for a warbird) 26 ounces. In addition, he's doing very good versions of the F4U Corsair and Lockheed P-80 utilizing familiar EPP construction techniques. Check with Bruce for pricing and availability of his kits; due to the duckets of rain at the last contest we were at together, it was hard to get productive notes and photos on his already wide range of planes, and I had to get this article in to Judy!

F-21 Predator

RPV Industries
Rick Powers
Palo Alto, CA
(415) 493-5502
rpvi@aol.com

The F-21 Predator has geometry very similar to the venerable Bob Martin SR-7 with a more advanced RG-15 airfoil and all EPP construction with Coroplast tail group. At 48 inches span, it's combat legal and is also suitable for bungee launching. The F-21 kits sell for $59.00 + $5.00 s/h for domestic orders; check with Rick for international shipping details.

AVRO Vulcan & MiG-3

Studio 'B' Design & Production, LLC
Lex Liberato
P.O. Box 514
Kurtistown, HI 96760
tel/fax (808) 968-8721
studiob@aloha.net
http://Planet-Hawaii.com/studiob

Studio B 48" span EPP AVRO Vulcans.

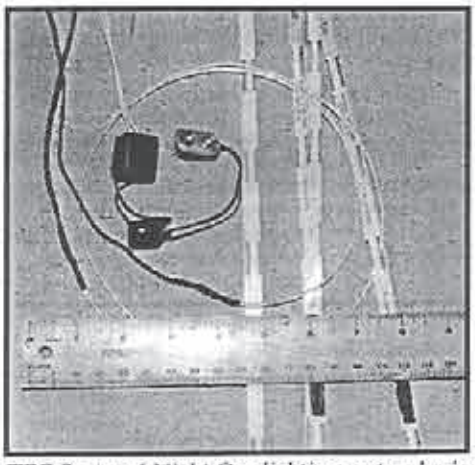
Yes, another Vulcan! This one however, is larger,utilizing the full 48 inch combat span limit to maximize efficiency. At $44.95 + $5.50 s/h, these are very well priced for all-EPP models and are quick building. In addition, they offer a good crossover of flying wing/tailed aircraft flight performance and low wing loading that has made delta-style planforms popular lately.

Also fairly recent is Lex's MiG-3, which is all EPP construction and combat legal with a 48 inch span and SD6060 airfoil. I've seen a couple of examples of this kit and it's a very nice aircraft indeed with impressive scale looks. It sells for $54.95 + $5.50 s/h for domestic orders. Inquire for international rates.

Night Ops Night Flying Lights

TEC Systems
3038 Sylmar
Clovis, CA 93612
(209) 291-0447
fax (209) 291-1459
tcone@lightspeed.net

THIS is truly revolutionary, friends... The best night flying light system you've ever experienced!! Night Ops is a complete, compact system to equip your plane with lighting that makes it so easy to orient, you'll feel like you're seeing your plane's shape in broad daylight. I've flown with the system installed on different airframes on two occasions doing 100 MPH+ bungee launches in dead-dark night and have found it as pleasurable and instinctive as flying at high noon. So what's so different?



TEC Systems' Night Ops lighting system basic components. Read about it! These are amazing; I'm not kidding!

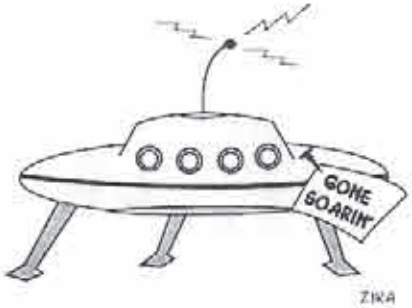
The light producing elements of the system are in two forms: four paper-thin luminous tapes about 5/16 inch wide and two feet long, and two pieces of luminous twine about 1/16 inch in diameter and 18 inches long. The tape-type elements are a little brighter and very suitable to run along the span of your plane's wings; the twine type works well to outline the plane's fuselage side view. With these cues, you feel completely confident in assessing your plane's attitude at any time. These lights are so bright, you can read by them! The light makes a sort of greenish glow that doesn't ruin your night vision, either.

The whole system, with 9 volt battery installed, weighs only four ounces, and the largest component is the battery itself! This is very good considering it's not much more weight, if any more, than a few Cyalume sticks and doesn't trash the aerodynamics of your airframe (if the power system and battery are enclosed in the plane; easily accomplished). I'll be doing a complete review of this system shortly, so please stay tuned to see the true elegance of it in action. If you just can't wait (and you shouldn't), get the system from Tim Cone at TEC Systems for $69.95 + $4.00 domestic shipping. California customers also give the Governor his 7.75% ounce of blood.

On to the Next Battle...

And so it is for a time... Is slope combat the first sign of the end of Western civilization? I dunno'... But it sure is fun, isn't it? Heh, heh, heh!

Off we ride into 1998. I hope you all had a good holiday season, and it's time to get back to the gritty work of knockin' down foam and watching hapless victims hike the hills! ■



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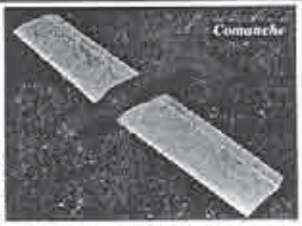

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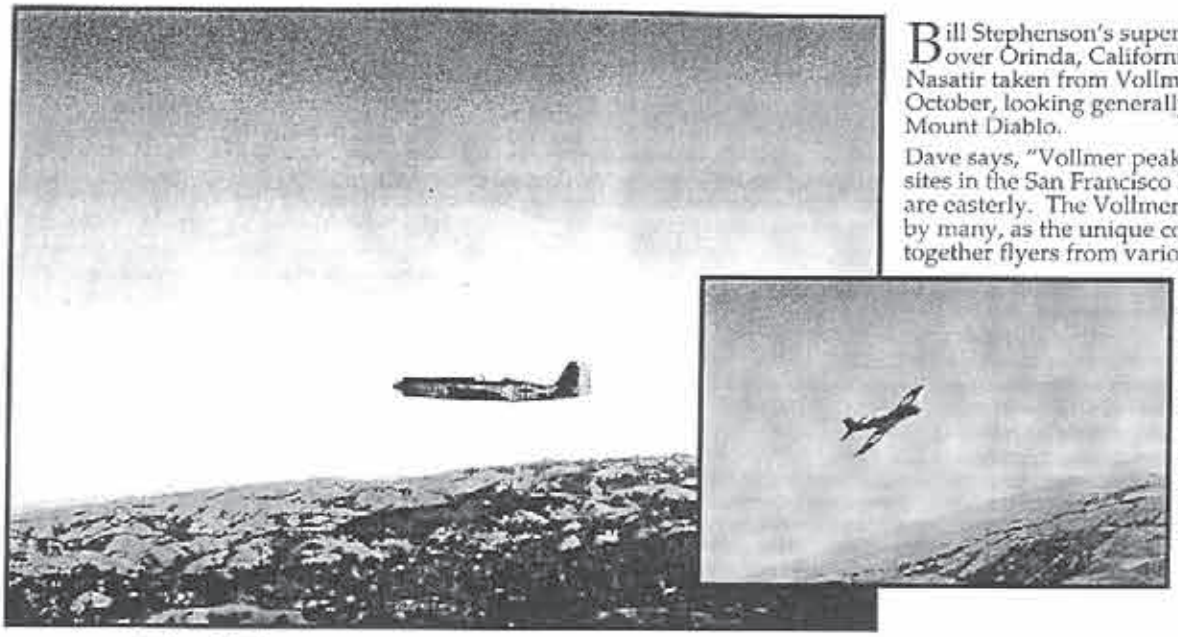

Bill Stephenson's superb "FoamWulf" in flight over Orinda, California. Photography by Dave Nasatir taken from Vollmer Peak in Berkeley, late October, looking generally eastward, toward Mount Diablo.

Dave says, "Vollmer peak is one of the premier sites in the San Francisco Bay Area, when the winds are easterly. The Vollmer experience is treasured by many, as the unique conditions there bring together flyers from various local sites for non-sanctioned, non-competitive, high (and low) performance flying in a stunning setting."

"Among well known locals often seen there are Bill Swingle, Phil Lontz and, of course "the amazing" (to quote Gordy Stahl) Dave Stone."

First Time

By William G. Swingle II
Pleasanton, California
bill_swingle@electro-test.com

There's a magic in sustained flight without an engine. This is why we fly gliders!

On a lazy afternoon at the slope recently, we were enjoying the usual hangar flying that occurs any time enthusiasts get together. The lift had been good that day; we'd had our fill of some great combat. In keeping with the serenity we were all enjoying, the winds too decided to calm, and were blowing softly at just a few miles per hour.

Then, the mood struck us again; several of us grabbed our light air planes and proceeded to investigate the newly forming conditions. The lift was soft, but ever present. It seemed too strong for the minimal wind, but there's no arguing with a rising airplane! We soared the slope, enjoying the tranquil gift the winds had presented us.

As I was flying the soft lift, I remembered the first time I actually got to see the bottom of my own, first glider in flight. It happened when I was sixteen. At the time, I had no idea what slope soaring was. I'd only heard the word thermal twice, and thought they were a myth. To be honest, the whole glider concept seemed odd to me. Why would you want to fly something that was just going to fall to the ground? Never-the-less, the glider was cheap, easy to build and available. To fly it, all I did was throw the plane off a slope, guide it to the ground and start walking. I did this occasionally, over the course of four years. I was learning on my own and thus progress was quite slow.

I began to get a glimmer of understanding when my cousin, Kevin, went to the slope with me. He launched the glider and was actually able to make a few passes! The wheels of thought began to turn. He didn't have a lot of stick time himself, and said very little on that trip. However, he did mention that the wind was good. I didn't know why and, frankly, gave it little conscious thought. Luckily, my subconscious was paying better attention. Though I didn't notice it at the time, my trips to the slope began to show a pattern of occurring on windy days. My trips also began to show a slight increase in flying time, and a proportional decrease in walking.

Initially, I'd only get one flight per trip. At first it was because of crashes. But, when the crashes became less frequent, the number of flights per trip still remained low. If I had a successful flight, I'd be elated by the prospect of returning home with an intact airplane. The thought of actually having the choice of calling it a day, without actually needing to, was very tempting. After a successful flight or two, I'd happily call it a day and bask in the glory of the success.

Then, on one of my flying trips, enlightenment occurred. The plane actually flew over my head. Gracefully, majestically and with grandeur, it floated directly over my head! I was awed. Realization hit me like a brick. In one huge flash, I suddenly realized I was actually defying gravity without an engine! This was a big moment for me. I landed and did not fly again that day. There was no way on God's green earth I was going to chance ruining the magnificence of that accomplishment with a crash or even a long walk. Right from the beginning, there was never any doubt that I was a lifer. And, after that flight over my head, I knew why. I'd found the magic. That which for four years I'd thought was impossible was actually conceivable. I'd seen the brass ring. I'd touched it!

We are magicians. Let us never forget the majesty and splendor!

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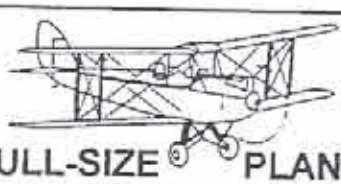

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We have referenced the following article many times since its publication in the *TWITT Newsletter* in May of 1995. We present it here in response to "popular demand."

BIRDS OF A FEATHER...

(*TWITT Newsletter* Editor - The following article was contributed by our Secretary, Phillip Burgers, at the request of Bob Fronius, our Treasurer, after a rousing session of feeding the sea gulls on New Year's Day at a local (San Diego) shoreline. The antics of the gulls while trying to catch bread tossed into the air fired a debate on how they used their tail feathers as flight controls. This is Phillip's answer to Bob's challenge. Read and enjoy.)

DOES A BIRD HAVE A TAIL TO TELL...?

by Phillip Burgers

Has a bird a tail or not?

Many of the readers may ask themselves if this question has any relevance to the goals of TWITT. Even though this following discussion seems academic or superfluous, I personally think that birds, together with bats, are the most sophisticated flying wings in existence today. What follows is a justification of this statement. This article is dedicated to those interested in flying wings, to Karl Sanders and to Bob Fronius, who were dear friends of mine... until they read the lines that follow. They started it all!

Let's define what we understand as a tail in an airplane.

The tail of an airplane is defined as a surface, be it vertical or horizontal, at the end of the aircraft's fuselage which supplies the following conditions for flight:

1) directional stability by means of a vertical surface;
2) pitch control, longitudinal trimming and stability by means of a horizontal surface.

Let's analyze each of the aforementioned functions of a tail and compare them with birds.

1) Regarding directional stability by means of the vertical surface: This is an easy one... A bird does not have a vertical tail. In birds, directional stability can be obtained by variable washout/washin of the outer part of the wing (as observed and entered by Wilbur Wright in his diaries in 1900) and at low speeds is being accomplished by the feathers attached at the end of its body. These feathers turn up to be actually low speed ailerons.
2) Pitch control, longitudinal trimming and stability during bird flight is not done by the tail, as in airplanes where there is a download on the tail. This primitive way of obtaining stability that we still use in our airplanes penalizes the aerodynamic efficiency during flight. The bird's pitch control and trimming is more sophisticated — it is done by adjusting the relative position of the aerodynamic center of the wing with respect to the center of gravity of the bird. At low speeds, the bird places the center of gravity backwards with respect to the aerodynamic center of the wing, so the back feathers (don't call it a tail yet!) act as a secondary lifting surface that lifts a small percentage of the bird's weight and in so doing it unloads the main wing.

So, the obvious question arises: What does the bird's tail do? The main function of the tail is to unload the main wing at high angles of attack, and in so doing it delays its stall. It does so by sweeping the wing forward, moving the center of gravity backwards relative to the main wing and "fanning out" its aft feathers to increase its secondary lifting area. This aft lifting surface area is exactly opposite to a canard surface: it is located behind of the main wing and has a low loading, while the canard is placed forward of the main wing and is highly loaded.

When the bird is at very high angles of attack, the tail is right behind the main wing and immersed in the downwash of the main wing. This is not a problem for the end feathers due to the fact that they form a low aspect ratio surface that makes it immune to the sudden changes in downwash of the wing. A high aspect ratio secondary lifting surface behind the main wing would stall with a small change in downwash induced by the main wing.

It is apparent at this point that the so called "tail" does act not only as a low speed aileron, but also as a flap. The other large function of this flap is to increase the lift of the main wing by creating an upwash in front of the wing.

A DIFFERENT APPROACH TO THE "BIRD DON'T HAVE NO TAIL" APPROACH

Even biologically speaking, the bird lacks a tail. Bats don't have one either. The last vertebrae of a bird are fused and called a pigystile. From the oseo-morphological standpoint, there is no tail to be found in birds, as we may find in dogs, rodents or lizards. Now let me get quickly back to my preferred field of work — aerodynamics...

IS THE FLYING WING THE BEST CONFIGURATION? ANOTHER APPROACH

People have discussed the merits of flying wings. Karl Sanders has been an excellent devil's advocate for flying wings and it is a challenge to challenge him, but there it goes, Karl... We are going to visualize (praise) flying wings from a different perspective.

It is probably safe to say that Man has learned how to fly from nature. What is also safe to say is that every time Man has strided apart from what nature had to show him, his designs have failed miserably. For the brief period of a year, roughly from mid 1917 to mid 1918, the triplane format suddenly came to dominate the world of fighter plane design, particularly in Germany. If we are in any way aware of this design, we must give credit to Rittmeister Manfred von Richtofen and to Anthony Fokker. Never more did this configuration came back. Nature never did favor two, three or any other larger number of birds flying one above the other. Flying in the downwash of another bird is not the idea that a bird has of flying efficiently. No airplane is flying at its optimum condition when flying in the downwash of another airplane flying in front of it.

In the seventies, the canard configurations (remember, it is the opposite of Nature's chosen configuration for a bird!) became fashionable. In the canard we find a very heavily loaded canard (so it stalls first) placed in front of the main wing. Even though from the safety standpoint this is an excellent arrangement, the main wing is immersed in the powerful downwash of the canard. We never heard of this configuration again in the civilian market. Why not? If we go to nature looking for help, we will find that no bird favors flying right behind another bird! In the military arena, canard configurations can be of benefit as long as the canard is not heavily loaded.

Throughout this article we have mentioned the word "configuration". If we define this word as the best way of locating one lifting surface in the most efficient manner with respect to another lifting surface and go to nature for the answer, we will see the best solution — a bird, which is a flying wing with a large secondary surface attached to it or so called flap for low speed.

So, the first round was won by the flying wing. If we are still not convinced, let's go one step further and see what birds do to reduce their intrinsic induced drag — they form a lambda formation (erroneously called 'V' formation, which would point to the wrong flight direction!). Here we see a large flying wing as the configuration (again) favored by nature, where every bird is part of the wing and every bird gains in lift and minimizes energy exertion by reducing induced drag.

It is most interesting to note that the flowfield around a bird formation as a whole is similar to the flowfield around a swept back flying wing!

A VERY SOPHISTICATED FLAP INDEED...

As to finish and prove once more that nature has always been ahead of us by millions of years and that it pays to look back at nature for the best of results, we will discuss now another remarkable example. The tail of the fork tailed sparrow or fairy tern.

At very low speeds, the tail of the sparrow or a tern goes down and the forked tail opens, slightly reducing the very large sweep of its leading edge feathers. At this point, vortex enhanced lift is present over the tail, giving it a very powerful source of lift and creating a sophisticated tool for unloading the main wing.

Did we humans ever use vortex enhanced lift in the horizontal tail of an airplane? Yes, we did, but without knowing it! Fokker, around 1918, designed his triplane airplane (the same we dared criticize earlier) and a unique feature was the sweep of its vertical and horizontal tail. It could achieve very large angles of sideslip and yaw, as well as pitching angles, without vertical or horizontal stall, by a combination of light loaded surfaces and vortex enhanced lift (at high angles of attack). Without realizing it, Anthony Fokker took advantage of the vortex enhanced lift long ago and we would start to use it in our supersonic designs. Vortex enhanced lift was used "knowingly" the first time by Dr. Reimar Horten in Argentina in 1953, on the high speed fighter I.Ae. 47 delta wing with highly swept wings with sharp leading edges.

CONCLUSIONS

As can be seen, the so called tail is actually a sophisticated second lifting surface or flap that can take the form of a low aspect ratio lifting surface or a delta wing in the case of the sparrow, creating vortex enhanced flow over it, or a single slotted flap on the case of most birds like the pigeon. At high speeds, when not needed, it decreases its wetted area and at low speeds it opens up by increasing its span not only to share the weight of the bird with the main wing but to create an upwash in front of the bird's main wing (any flap does this). Once more it seems that nature is telling us something about the efficiency of flying wings. But for us to imitate a bird will be an unreachable goal as long as we do not have reliable active stability mechanisms to keep the unstable flying wing flying! We seem to be flying in the stone age with airplanes with a download in their horizontal tails!

Last but not least, I would like to invite our worldwide TWITTers to contact me if you have any information on ground effect, formation flying, and documentation (videos or still photographs) of birds flying at very high angle of attack and videos on birds flying in ground effect and in formation simultaneously. This information would be highly appreciated.

Phillip Burgers, 2556 Nye Street, San Diego, CA 92111

TWITT (The Wing Is The Thing), P.O. Box 20430, El Cajon, CA 90403

■

T.W.I.T.T.

(The Wing Is The Thing)

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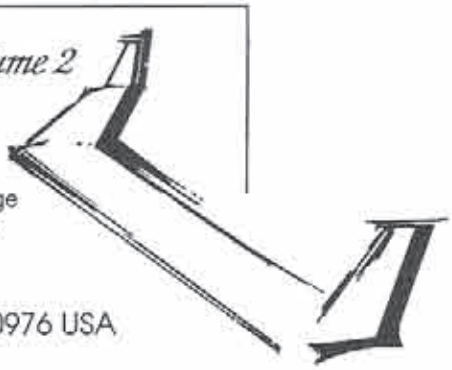

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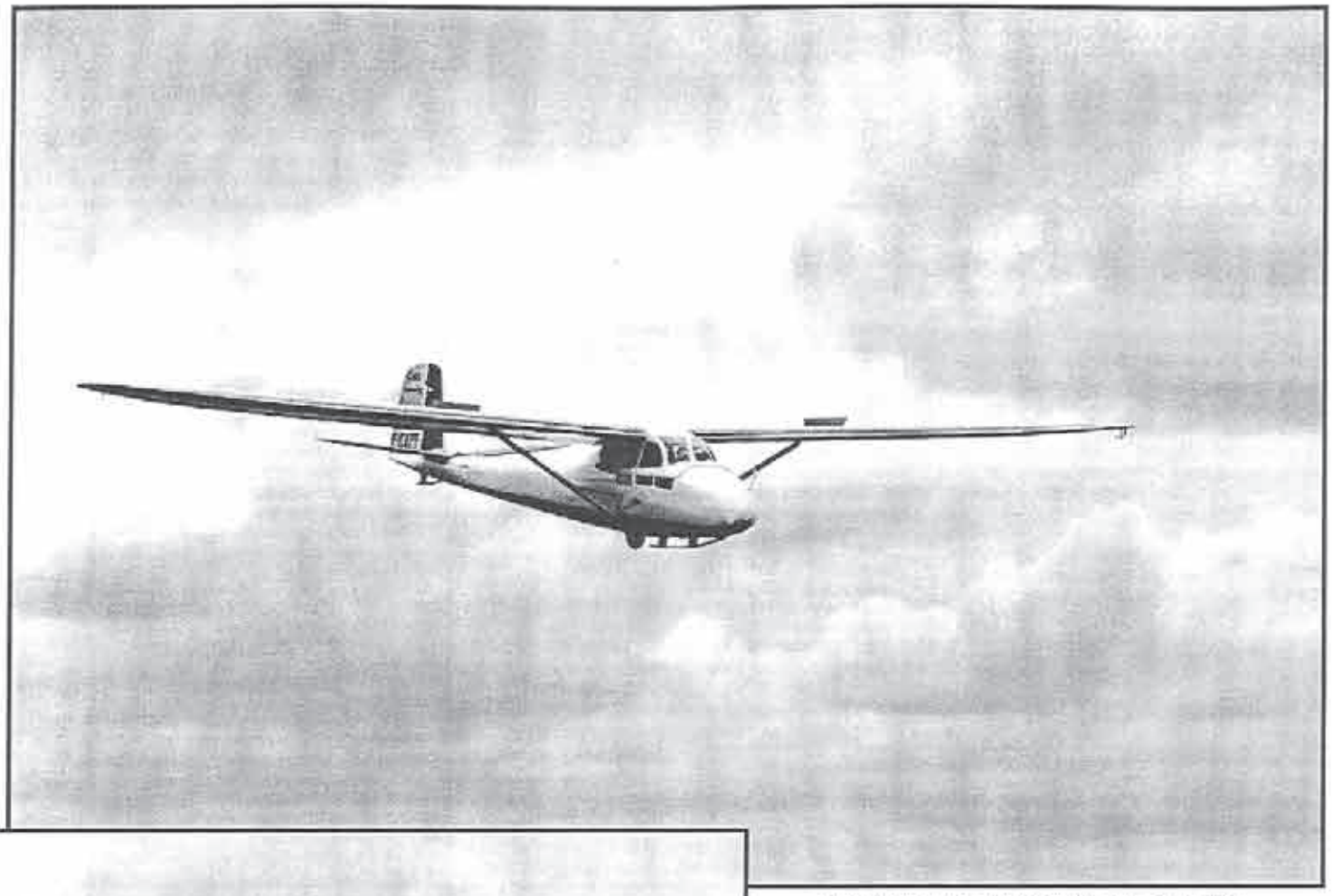
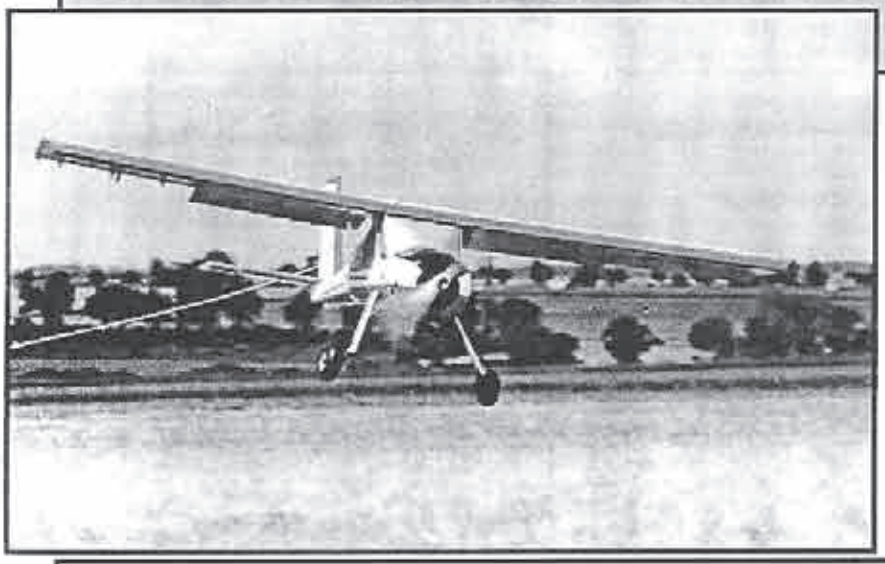


Beautiful scratch built c-800 by Benoit Baradon.



The trusty Wilga coming in for another tow.

The friendly group at the event.

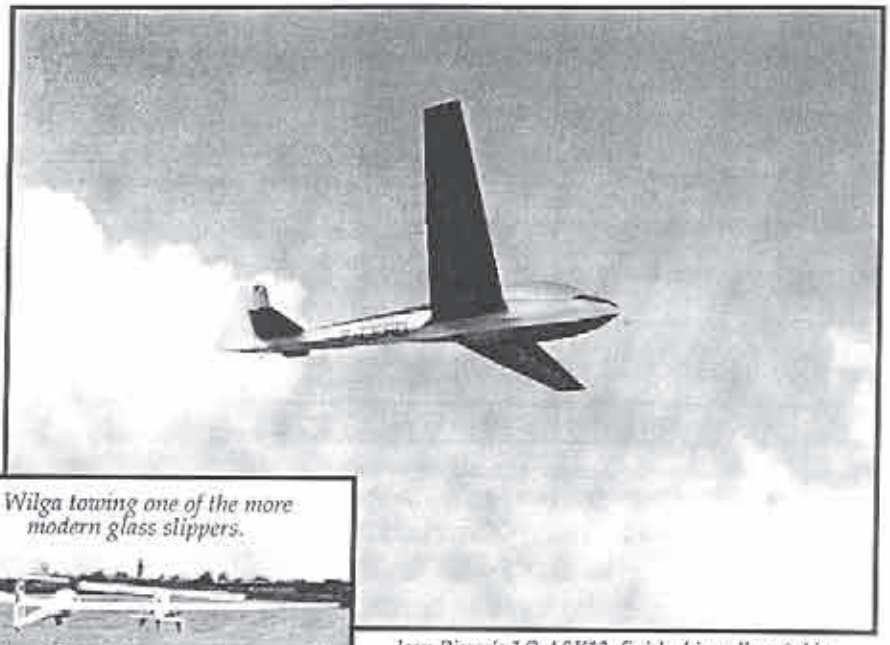
Robin Lehman
63 East 82nd St.
NYC, NY 10028
(212) 879-1634

The First French Airtow Event in Normandy a Great Success!

I hear that the Aeroclub of Caen (in Normandy, France) held their first airtow fun fly in June 97, and everyone there must have had a wonderful time! The weather cooperated and I am told that the 21 pilots present put in 1655 minutes of flight with 126 tows over the two days - and all this, with a lunch break! They had 31 scale airplanes there with five towplanes (3 Wilgas).

Most of the sailplanes were scratch built, using a glass fuselage and plans for the wings and stab. A few were completely

Not only is it a very relaxed flying atmosphere, but good babysitters, to boot!



Jean Pierre's 1/3 ASK13, finished in yellow & blue, 5.26m span, 30 lb. Scratch built except for the fuselage.

A Wilga towing one of the more modern glass slippers.

scratch built, like Benoit Baradon's beautiful and rare c-800. Although there were a few gliders in the 2 meter class, most were 4 meters and up. There were over 25 different sailplane types represented from the most modern glass slippers back to vintage types. There were Crystols, Ventus c, Discus, LS 4s, ASH 25, Nimbus 3, Jantar, ASW 24, Twin Astir, Pilatus B4, ASK 18, ASK 13, ASW 17, ASW 15B, Ka6Es, c-800, GO ET LENT, and quite a few others. Nine of these were in the 5 meter class and up. Almost everyone brought something different to fly.

Interestingly, the three longest thermal flights were by an ASK18, an ASH 25, and an LS 4.

The towpilots had quite a workout keeping things going. The three Wilgas were powered by a G-62, a 3w70 twin, and an 80cc motor pulling a 26/8 prop. A Big Lift and a Bison got the smaller sailplanes aloft.

It seems that although airtowing is just coming into its own in France, everyone had such a fabulous time their first time out that they plan to get together again in 1998. If you happen to be in the Normandy region of France on June 13-14, get yourself to the model airplane field in Fresney le Puceux (10 Km from Caen), where you are likely to find great hospitality, a bigger and better group of sailplane enthusiasts, lots of different scale ships, a whole gaggle of towplanes, not to mention some wonderful French food and wine along the way. You may contact Jean Paul Voisin at 011-332-31 80 50 73 or Bernard Collet, who speaks English, at 011-332-31 73 55 28. (This is how you dial it from the USA.)

Acrobatics

Airspeed is perhaps the single most important component in aerobatics. Too little or too much and you will have difficulty getting your glider to perform properly, because each maneuver requires more or less just the right amount.

When you are sitting in the cockpit of the real thing, you have the airspeed indicator to go by, but how can we tell exactly how fast our R/C sailplane is flying when we are standing on the ground? The real answer is, "We can't." It's all guesswork. We judge visually as best we can, but it IS guess work.

Now that we've started to try some aerobatics with our gliders, we are beginning to learn a bit more about airspeed. Also, we are regularly flying maneuvers both up and down wind and this can cause unforeseen problems, because of the sometimes BIG difference in apparent air speed going upwind and downwind.

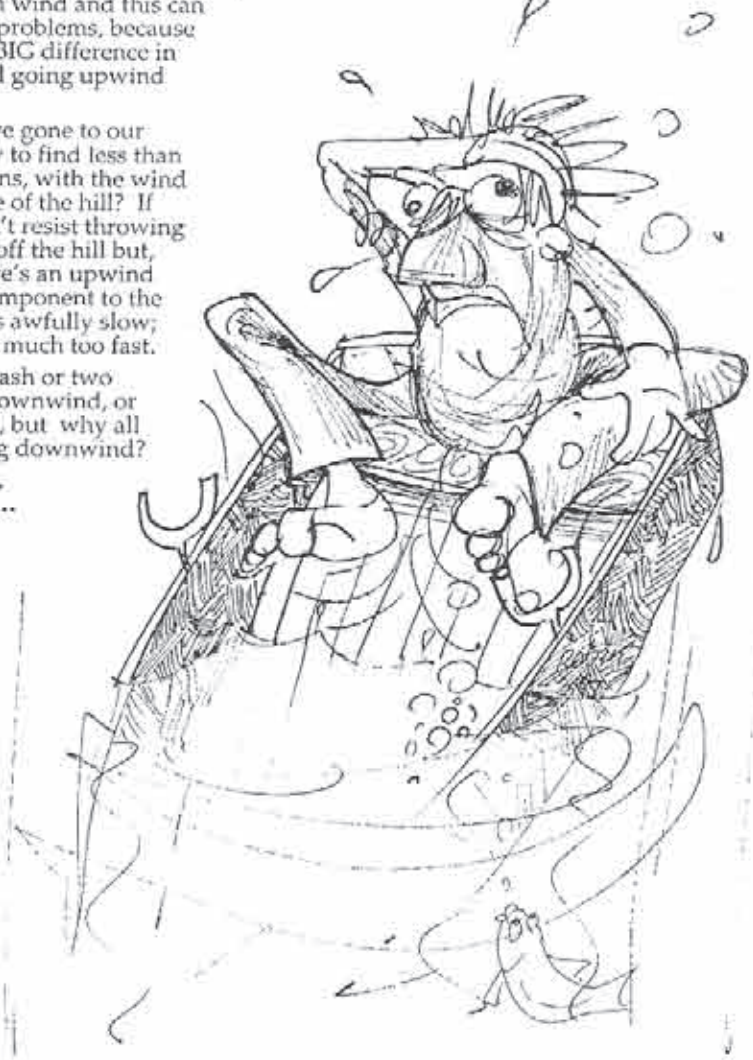
How often have we gone to our favorite slope only to find less than optimum conditions, with the wind slanted off the face of the hill? If it's flyable, we can't resist throwing our pride and joy off the hill but, when slanted, there's an upwind and downwind component to the lift. Upwind seems awfully slow; downwind seems much too fast.

We've all seen a crash or two caused by flying downwind, or so we've been told, but why all the problems flying downwind?

Upwind, Downwind...

I heard from a friend the other day; it seems that they were airtowing for the first time and running into problems every time they turned and flew downwind. How many zillion times have I heard pilots say, "...It fell out of the sky when I turned downwind." What's really going on here?

Fully half the people flying R/C aircraft believe in this myth. And there is almost no way to talk them out of it! I've heard the same thing many times, so I thought it might be a good idea to try to put the



record straight.

Now I am going to open a real can of worms. Let's not go fishing, but let's get into a boat and row a little. It's good exercise and it may help your flying!

Row, Row, Row Your Boat

You're in a lake, sitting in a rowboat. You look down and you see that there's a hole in the hull by your feet. You find you must keep rowing at or above 5 MPH to keep the water out. Slower than that and water comes in through the hole. You row your boat for a while, keeping the water out until you feel you've had enough; then you turn around and row back to the shore, and call it a day. All this time you've kept the boat speed at or above 5 MPH and no water has come in. Your friend on the shore sees you rowing at a constant speed and is not concerned about your leak. You go home with every intention of fixing the hole in the hull, but...

Next weekend, you decide to take your boat out again, this time to a river.

You still haven't fixed the hole in the hull! No sweat! You know that you can row at 5 MPH to keep the water out. You launch your rowboat and proceed to row upstream for awhile at 5 MPH; then you turn around and row down stream at exactly the same speed, all the while, keeping the river water from coming into the hull.

It's obvious that if your speed over the water is a constant 5 MPH, your boat won't leak. But your friend on shore was quite concerned to see you going so slowly up stream. He called out, "Row faster!" He was sure you were going to sink, and when you turned around and rowed down stream, he was equally sure you were going much faster than needed to stay afloat. He would be wrong on both counts, wouldn't he? Both up and down stream you were only going just fast enough to keep the water from coming in, a constant 5 MPH, regardless of what the boat speed seemed to be from your friend's point of view.

Another example: You've all heard about how sharks must keep swimming (they are heavier than water) or they will sink. Now you're a shark and you know you must swim at least 5 MPH not to sink. You swim in and out of the Gulf Stream and whether you are swimming up or down the current, as long as you stay at or above 5MPH, you don't sink. Obvious, right?

So what's all this got do with R/C aircraft?

Let's Go Flying

Everyone will agree that on windless days, our R/C airplanes fly the same in any direction. Fly North, South, East or West, and it makes no difference at all. Now why is that? Because there is no wind, of course, and with no wind, the ground speed and the air speed are the same, no matter which direction you head. That's why it's so very nice to fly on a dead calm day. Give me a calm day, anytime!

Aerobatic Flight Plan

October 1997

- Uncouple your rudder & ailerons.
- Practice flying Straight & Level.
- Master airspeed.
- Practice the Inside Loop.
- Determine what rudder & aileron adjustments are required to fly a perfect loop.
- Tackle Inverted Flight.

November 1997

- Practice the Split-S or Wing-over.
- Practice gaining sufficient airspeed to be able to complete a 360° Roll.
- Practice The Roll.
- Combine maneuvers to develop your personal, custom, aerobatic sequence.

December 1997

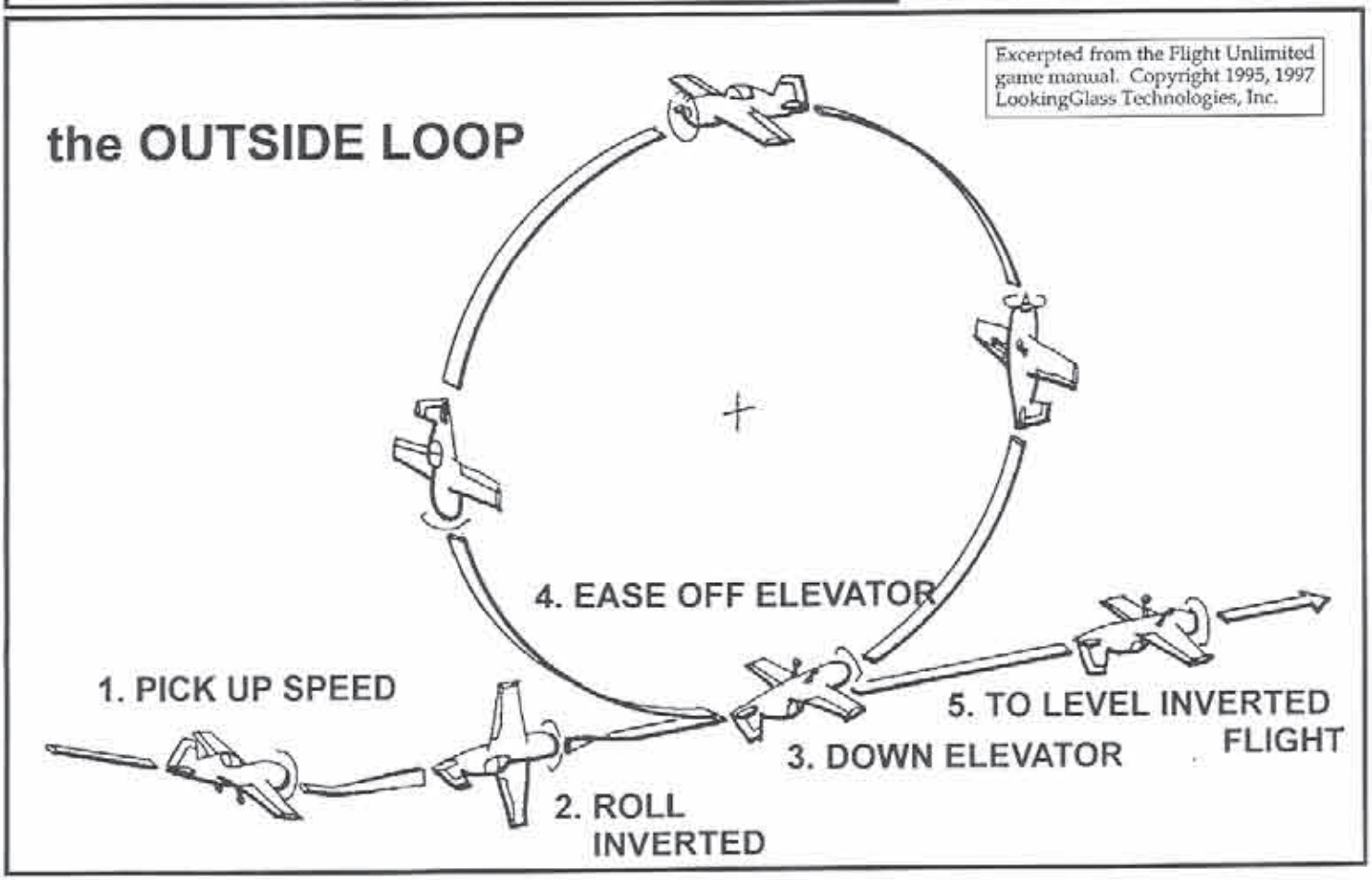
- Practice 1/2 Cuban 8.
- Practice the Cuban 8.

January 1998

- Practice the Outside Loop.

Notes:

- Establish and maintain a "Sailplane Diary" for each plane.
- Review monthly progress.
- Practice flying with a knowledgeable friend or expert, and remember that safety comes first.
- Practice with a flight simulator program such as Flight Unlimited (April, 1997 *RCSD*).
- Definition of "One Mistake High": Be darn sure you're high enough to complete the maneuver and make one mistake, before hitting the ground.



Now, let's say you want to fly a glider which will stall at below 20 MPH. You decide to fly it at 20 MPH. You go out to fly and the wind is blowing 10 MPH from the North. When you take off into the wind, your ground speed is slowed by 10 MPH, and when you turn around and fly downwind, your ground speed is increased by 10 MPH, which makes your airplane seem to fly much faster. But is it really flying any faster? Remember, it's the air flowing over the wings which keeps your bird flying, so the question becomes, "Is the minimum flying air speed really any different upwind than downwind?"

Well, the obvious answer has to be, "NO."

For illustration, let's say that your glider flies at 20 MPH just above the stall speed. Flying upwind, to the North, your speed over the ground would be only 10 MPH (airspeed of 20 MPH - 10 MPH headwind = 10 MPH round speed). The glider would appear to be flying slowly, but its airspeed is really a safe 20 MPH. When you turn around and fly downwind, you will appear to be flying very fast, because your ground speed now becomes 30 MPH!!!!!! (Airspeed of 20 MPH +10 MPH tailwind = 30 MPH speed over the ground.)

So, with a fairly light wind of only 10 MPH, your upwind ground speed is only 10 MPH, while the downwind ground speed becomes a whopping 30 MPH. Remember, all this is flown at your minimum flying speed. Now, guess what happens if you slow down at all. THE AIRPLANE STALLS AND FALLS OUT OF THE SKY. It's no wonder that we all sometimes have problems flying downwind.

We always try to take off into the wind, and so the takeoff seems to be slow. Our reaction is to speed up. No problem. Because our airplane seems to be flying so slowly we have a tendency to fly it a little faster, and so we will be flying above the stall speed. But when we turn and fly downwind, the airplane appears to be flying much too fast, and so we often try to slow it down; that's a BIG mistake, which often leads to a crash.

Ground Effect

Do I still hear a few voices out there talking about ground effect? The fact is that ground effect only comes into play about one wingspan off the ground. Fly any higher than that, and there is NO ground effect.

Back To Basics

Now, remember my friend who has the airtow problem when flying downwind? The answer is, "Don't fly any differently downwind than upwind." Trim the towplane and the glider for climb; then, leave everything alone. DON'T TOUCH THAT ELEVATOR.

What's the lesson in all of this? Don't mess with airspeed. FLY AT THE SAME AIRSPEED, BOTH UP AND DOWN WIND, and you will never have a problem.

Happy landings; let them be mostly into the wind!

Back To Aerobatics

For those of you who know all this airspeed stuff, now let's go and have some fun!

You all know how to do a loop, and you have tried inverted flight, so now let's combine the two with the outside loop.

The Outside Loop
(difficult for some airfoils)

The Outside Loop is done exactly the same as the Inside Loop. The only difference is you fly it inverted.

The model starts the Outside Loop flying inverted straight and level, and with a lot of airspeed, pushes down elevator down, flies up into a perfectly round 360 degree loop and finishes inverted straight and level in exactly the same heading.

The outside loop can be flown up as described above, or down. The glider starts straight and level inverted, pushes up elevator (goes down) into a 360 degree loop and finishes inverted flying straight and level. This is an easier outside loop because you don't need much airspeed to begin the maneuver because it starts going down instead of up.

This maneuver is not particularly difficult, but as with all aerobatics, airspeed, AIRSPEED, A*IRSPEED! Is really important!*

The key to all loops is keeping your wings exactly horizontal, and flying a perfectly round 360 degree vertical circle. On windy days, or if you must do your Loops cross wind, you sometimes need to steer the sailplane through the entire Loop to keep the wings exactly horizontal. This is why on windy days it's much more difficult to do precision aerobatics than it is on a calm day. We are flying very close to the ground, and often the lower you get the bumpier it is. When the full-sized sailplanes do such maneuvers, they are much higher and much faster and much more stable and, therefore, are affected much less by ground turbulence.

Just remember one very important thing: *when inverted, up elevator makes the airplane fly down, and down elevator makes it fly up.* As always, if in doubt, fly one mistake high!

Now go out and HAVE FUN! ■

Early morning, just prior to first flight.

Scale Electric Project

By Art Kriesen
Webster, New York

To begin at the beginning would entail going back some 30 years to the time when my office mate introduced me to soaring. Ed Seymour, now in his 80's and still flying both gliders and tow planes, introduced me, but never convinced me to fly. Not only was the expense too steep, having three young children to look after, but the following story assured that both my feet would stay firmly planted on the ground.

Ed was an experienced pilot and, one day, decided to do a few stunts for his son, observing on the ground. After a few rolls and spins he decided to do a loop. At the max G pullout the main spar snapped and off came the wing. Luckily, Ed was wearing a parachute and, after some struggle, managed to get out and pop the chute. There's more. On the way down, the crippled glider swung around and severed Ed's chute. Yes, he had a reserve, which is why I can relate this story.

While I did not pursue flying full scale, this association started a 30 year interest in these beautiful greyhounds of the sky. Many trips to Dansville and Harris Hill followed during those years. Then, Robin Lehman and John Derstine put together the First Elmira Aerotow, and the world of large, scale sailplanes grabbed a hold of me. I had been flying 2M electric for a few years, but had never seen anything like the 4 to 6 meter beauties at Elmira. There was a problem, however. I was not going to be able to find an aerotow where I live, and winch launch of a large, scale sailplane did not appeal to me (too much trouble and not enough altitude). The obvious alternative was a large electric, but as I started to research the various kits available and compute the resulting weight with electric, the term "lead sled" was graphically illustrated. Since our local soaring field does not generate strong thermals, to stay up at all, you must have somewhat of a "floater".

All the forgoing blather finally brings me to the point of this article: how to go about building a 3 meter, electric, scale sailplane with an all up flying weight of 80 oz. or less.

This specification and, in fact, the design process for the entire project was derived by deductive logic. That is to say, pulled directly from the seat of one's pants! How did I get to 80 oz. and a 3 meter? Simple. I wanted to use my 7 cell packs (I already had a bunch.) in series (14 cells). The most efficient use of this cell count I could find was an Aveox 1409/2Y with a 3.8:1 Planeta gear box spinning 14.5/7 prop. This combination weighed 40 oz. Now, using the electric rule of thumb that states the air frame should weigh no more than the propulsion machinery, another 40 oz. gets me to 80 oz. total. What is the span of a good flying scale sailplane that weighs 80 oz.? Right, 3 meters!

I looked at every catalog I've got and discovered that all 3 meter scale sailplanes without electric came in at around this number. The only problem was that, somehow, I needed to get to a bare air frame weight of only 40 oz. for a 3 meter scale sailplane; I guarantee you that there is nothing out there in kit form that even approaches that weight.

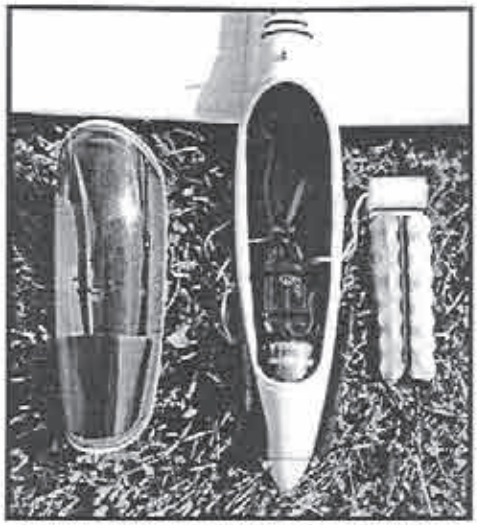
However, since there are available at least three, non-scale, electric kits that I know of that come in at about 80 oz. (plus a little), I reasoned that the key to this had to be the weight of the scale fuse. I also knew from canoe racing that a gel coated fiberglass (same construction as most scale kits) canoe weighs about twice as much as one made from 100% Kevlar. So, if I could find a Kevlar™ scale fuse, I'd be home free.

My search started by calling just about everyone advertising in *RCSD* and then calling the people they recommended. No one makes a scale Kevlar™ fuse. Finally, I came across Michael McKeown of Performance Composites in Napa, California. After some discussion and consideration of alternatives, he agreed to give it a try. What was amazing to me was that Mike was willing to go out and get a mold and then experiment with various layup schedules all for the sale of one scale fuse. His enthusiasm for this sport is obvious. Thanks again, Mike.

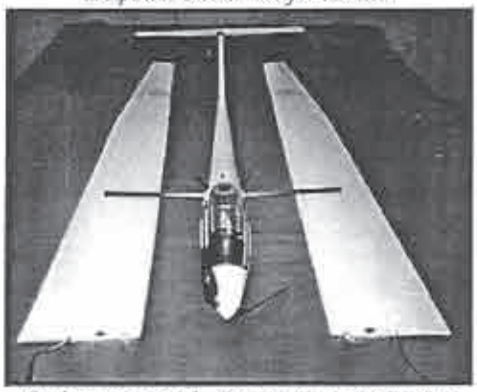
After some 30 e-mail messages and a few months time, I had in my possession three, scale ASW-22 fuses. The first to arrive was an E-glass/Kevlar™/carbon creation used to verify the layup schedule. Mike sent that one for free! The two Kevlar™ ones (volume discount) came shortly thereafter. They were both extremely stiff, especially in the cockpit area, which tends to be the weak point. They were reinforced with carbon in the fin, producing great torsional stiffness, even without the rudder plate to box in the structure. One weighed 10.5 oz. and the other 9.6.

I now had a 50 inch scale fuse of an ASW-22 that was very strong and within my weight budget. Time to start thinking about the wing.

Earlier I had talked to some wing builders to determine if a 25 oz., three meter wing was possible. Words like "challenge" and "a stretch" were heard. No one said, "You're out of your mind." Thought maybe, but not said. Here again, Mike



Cockpit detail, motor installation, and 14 cell motor pack plus radio battery. The vents aft of the power switch are for air exit.

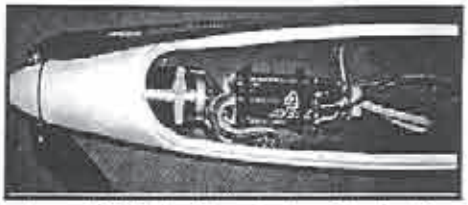


Carbon joiner rod. Two servos in each wing connect with a 4 pin Deans connector.

McKeown had been very helpful. Earlier in one of those 30 e-mail messages, he had included the specifications for a true scale wing to go with the ASW-22 fuse (something like 149 inch span with an aspect ratio in the 30's). He even suggested that a 14% Quabeck would be his airfoil choice.

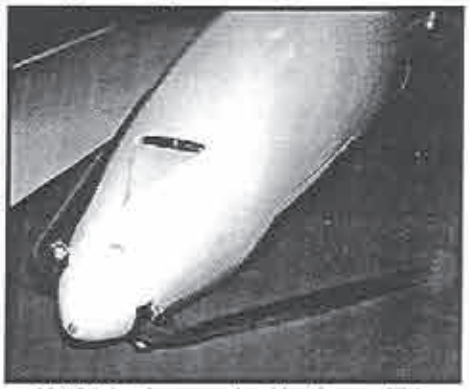
So, now I was down to the really scary part: designing the wing. This exercise was governed by the aeronautical principle "If it looks right, it will fly right", which is another variant of the deductive logic approach mentioned earlier. I used the information provided by Mike and the scale drawings in Etienne Dorig's ICARE Sailplane catalog to guide me as to what "looked right". What resulted was a wing panel 65 inches long, with a root chord of 7.5 inches and 3.5 inches at the tip. The wing has a slight sweep back (1 inch) and a 5° dihedral. The trailing edge tapers forward from the root to the tip. Full width flaps and ailerons are used. No spoilers, but the ailerons would be used as spoilerons. With tips and accounting for fuse width, the span is 137 inches. Aspect ratio (using average chord) is 25:1.

At about this same time, there was an article published in *RCSD* that talked about a very light and strong wing design, consisting of obeche covered white foam, a carbon tube spar and a carbon joiner rod. I also noticed that this was precisely the construction offered by Paul Perret of Perret's Studio in New Orleans, Louisiana



Aveox 1409/2Y with controller. Simple, tidy installation. This combination, with a 14.5/7 prop on 14, 1000mAh cells, produces 80+ oz. static thrust for 90 seconds.

Cockpit detail. Weight of 2.65 oz. including canopy. Canopy from Viking Models, U.S.A.



NACA intake on underside of nose. This intake, combined with the exhaust vents aft of the cockpit, proved very effective. Motor, controller, and battery pack were just warm to the touch after landing.

for his Lasoar 960. Paul also sells two electric's, the Lasoar 650 and 1200, so he certainly would know something about what would be appropriate for electric flight.

I explained to Paul what I was trying to do, what my weight goals were and so on. He picked up a finished panel of his 3M Lasoar 960, weighed it and announced, 11 oz.! ALL RIGHT! I was in business. Paul agreed to do the custom wing to my specification; in a few weeks time I had two 65 inch panels that weighed 12.5 oz. each after capping the leading edge, flaps and ailerons.

If you have been keeping a mental note of the weights (and by intuition accounted for the 3 oz. joiner rod) you know that the total is 38 oz. Wow. Two oz. under the budget! Great! Well, not quite. Remember the saying that the "Devil is in the details"? Please, also remember, that those details have weight. But how much could that be? A lot, it turns out.

Scale ships must have cockpit detail	2.65 oz.
A nicely painted white fuse	.55 oz.
A rudder	.35 oz.
Horizontal stab	.60 oz.
Oracover on the wings (I can't paint)	4.20 oz.
Servos and wire	5.95 oz.
Radio and antenna	1.1 oz.
A bunch of other stuff in there somewhere	3.9 oz.
Batteries, motor, prop, controller	41.0 oz.
Plus the air frame as above	38.0 oz.
Total all up weight ready to fly	98.3 oz.

OK, that's not very close to the 80 oz. goal, but it is still less than what I would have had putting my 41 oz. of electric propulsion equipment into an 80 oz. kit. Also, we're talking about 3.5 M here, not 3.0 M. The real issue is, "How would it fly?"

To tell the truth, the plane was finished for a couple of weeks before I found a suitable day (i.e., worked up the courage) to do the trim flight. As I was driving out to the field, the following was going thru my mind. Thought one. You have just spent the entire winter and not an inconsiderable sum of money on a project that in one hour's time may occupy a hole in the ground. Thought two. There are people out there who make their living designing airplanes and know what they are doing. You are not one of them. Thought three. Didn't I just read something about how models don't fly well with long skinny wings? Something to do with Reynolds number, whatever that really is. Thought one again...

I arrived early, before anyone else. Should I do this without an audience and save myself some embarrassment? No, I need someone to launch, so I can devote my full attention to flying this "thing". Remember, the first flights of previous models? All over the place. Must have full attention on flying.

Eventually some stalwarts showed up, range checks were made, and the time had come. Now, I'm going to give you a third rule of thumb, "Big planes fly better."

Up it went, straight and true, with little elevator correction needed for power-on flight. With a measured static thrust of over 80 oz., this bird was on the edge of my sight very quickly. There was some wiggle-waggle (yaw) corrected by mixing in some rudder with the ailerons. Flaps at 20° allowed lazy circles in the sky. The spoilerons were effective, dumping altitude quickly.

So, what about the "floater" capability? The first flight in dead air, with a max of 90 second motor run time, lasted 14 min. The following week, in mid morning, I hit a thermal during climb out and both my spotter and myself experienced the "blink and it's gone" trick. Fortunately, we each did this at different times. Can this bird thermal? You bet!

Somehow, everything came together and worked just great. As with most things in life, the coming together is the result of help from many people. I would like to thank a few:

First, Mike McKeown, without whose effort this project would not have started.

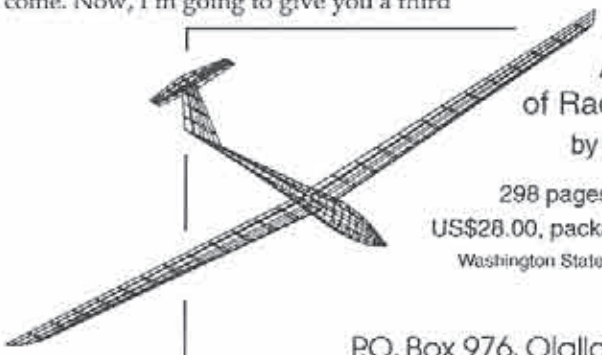
Paul Perret for a great set of wings.

Etienne Dorig, not only for those scale drawings, but also for an enlightening letter on the effect of weight on thermaling characteristics.

David Lane for discussion of wing design and the feasibility of my weight goals.

John Burrows for his experiences with a 2.8M ASW-22, electric.

Finally, my last rule of thumb, "Just do it!" Regards to Nike. ■



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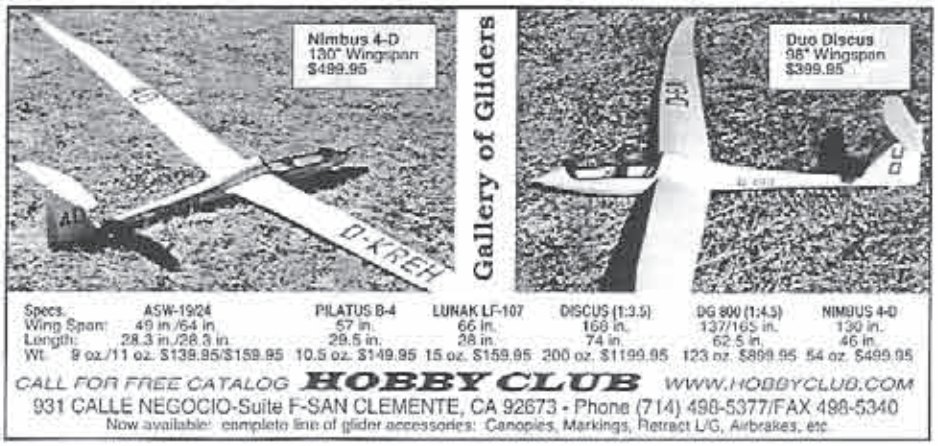

Specs.	ASW-19/24	PILATUS B-4	LUNAK LF-107	DISCUS (1:3.5)	DG 800 (1:4.5)	NIMBUS 4-D
Wing Span:	49 in./64 in.	57 in.	66 in.	168 in.	137/165 in.	130 in.
Length:	28.3 in./28.3 in.	29.5 in.	28 in.	74 in.	62.5 in.	46 in.
Wt.	9 oz./11 oz. $139.95/$159.95	10.5 oz. $149.95	15 oz. $159.95	200 oz. $1199.95	123 oz. $899.95	54 oz. $499.95

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Strong Trailing Edges for Built-up Wings

By Bob Johnson
Fond du Lac, Wisconsin

One of the many aspects of soaring, from which I derive pleasure, is seeing light shining through the transparent film covering on a built-up wing when a glider is at altitude, especially if the sky is a bright blue with scattered cumulus clouds. Apparently, there are others who feel the same, for several people commented to me about how neat the Bird of Time, covered with transparent red/yellow Monocote®, I flew at the 1997 Nats, looked as it floated on the ever-present thermals.

I feel that one shortcoming of a built-up wing is the relative weakness of the balsa trailing edge normally used in this type of construction. It is prone to warping and hangar rash and cannot be sanded to a sharp edge. I have seen kits and magazine construction articles where the trailing edge is made from spruce or basswood in an attempt to improve its durability. I find both materials somewhat difficult to shape, and so have rejected their use for constructing trailing edges. Also, neither spruce nor basswood can be sanded to as sharp an edge as I desire.

After some amount of experimenting, a solution was found that has all the characteristics I was seeking. The only disadvantages to the construction technique utilized are that it adds some time to the building process and it can add some weight to the completed structure. With proper sequencing of the building steps and judicious selection of balsa, both disadvantages can be minimized.

I construct the trailing edge of balsa that has been glued to a piece of 1/64-inch plywood. The bonding agent I use is Aerospace Composites EZ-Lam, although I am sure there are other adhesives that will work equally well. Whatever you choose for glue, be sure that it is thin enough to readily penetrate both the balsa and the plywood. To clamp the plywood and balsa together, while the resin is curing, I vacuum bag the pieces. This is the part that takes time, as the resin must be allowed to cure for approximately 24 hours. If you make laminating the trailing edges the last operation performed in a building session in the evening, the resin should be cured enough by the next day so you can continue building. The laminated trailing edge is then substituted for the original trailing edge material when the wing is constructed.

The secret to making a strong trailing edge using this process is to have the grain of the outer layers of the plywood running in a chordwise direction and the grain of the balsa running in a spanwise direction. I repeat, the visible grain of the plywood must run in a chordwise direction.

My source of plywood is Sig Manufacturing. It is available in a sheet four feet long and two feet wide. For my first attempt, cutting was done parallel to the long dimension, resulting in the outer grain of the plywood running in a spanwise direction. When the wing was covered, the trailing edge assumed a very nice reflex curve that was virtually impossible to remove! Also, the trailing edge did not have the physical strength I was seeking. In part, the less than satisfactory result may have been because I adhered the balsa to the plywood with super glue rather than epoxy.

While the first laminated trailing edge was significantly better than one made of balsa, spruce, or basswood, I felt there was still room for improvement. After some consideration I reasoned that to prevent the trailing edge from curving, the wood grain should run chordwise rather than spanwise. The question was, "Should both balsa and plywood have their grains chordwise, or should only one of the materials have its grain chordwise?" If only one of the materials was to have a chordwise grain direction, should it be the balsa or the plywood? After further consideration, I decided to orient the visible plywood grain in the chordwise direction and the balsa grain in a spanwise direction. The reason for doing it this way was that I felt the trailing edge would be easier to shape with the balsa grain spanwise. Also, with a chordwise grain for the balsa, it might be possible to use the trailing edge material that came with the kit.

I tried it, and it worked! My trailing edges then displayed the characteristics being sought; they were substantially stronger than balsa, could be sanded to a sharp edge, and did not curve when covering was applied. I was so pleased with the results that I never did experiment with a lamination in which the balsa grain ran in a chordwise direction.

The complete operation is a three-step process:

1. Laminate the balsa and 1/64-inch plywood trailing edge. Again, I strongly recommend a laminating resin as the adhesive. If you substitute balsa for the trailing edge stock that was packaged in a kit, make the thickness of the piece you use equal to the thickness of the original trailing edge stock.
2. Sand one side of your balsa/plywood trailing edge laminate so that it is straight and has an edge that is perfectly square; then use the laminated piece when you build the wing. I use a sanding block two feet long for squaring the trailing edge.
3. Carve the newly attached trailing edge to shape. While it is possible to do some carving before using the trailing edge piece in the construction, I find the shaping process easier with the trailing edge attached to the wing. I begin the process with a razor plane and complete it with sandpaper. At the October hobby show in Chicago, I saw a power plane demonstrated that should be perfect for this operation.

With a little care, you can have a wing with a strong, straight, and reasonably sharp trailing edge. I have heard stories about individuals using the trailing edge of their composite wing to slice a watermelon. While not being up to that task with my wings, I am completely satisfied with the results achieved by laminating the trailing edge as described and will continue doing so on future building projects.

If you have any questions or comments, my address and phone number are: Bob Johnson, 453 Roosevelt St., Fond du Lac, WI 54935, (920) 922-6705. ■

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The Condor is designed by Mark Allen, who is considered one of the best model sailplane designers in the United States, if not the world. Mark has taken all of his previous experience in competition thermal duration flying, plus all the knowledge he has gained from his earlier contest and sport designs, to design the Condor. Mark Allen's previous planes, to name only a few, are: Falcon 880 and 800, Falcon 600, Swift, Thermal Eagle, Vulcan, Night Hawk, Sky Hawk, Electric Hawk, Falcon 550E, Rocket, Pocket Rocket and, of course, the molded, world championship F3B Eagle. By taking the best of these designs and the new construction techniques available today, Mark has come up with, what we feel, is the absolute best open-class sailplane available.

The wings are made in America by Ron Vann, owner of Spectrum Enterprises. Ron is also an avid competition flier, and is considered to be one of the best wing manufacturers in the industry. Taking his years of experience in manufacturing wings, Ron has produced wings and stabs for the Condor that we feel are world class. Starting with the spar that Mark Allen designed, Ron uses only the best and most accurately cut foam cores available. He then uses hand picked obechi from Kennedy Composites, which is applied with West Systems epoxy. This is after he has first reinforced the wing with carbon fiber and fiberglass. The servo wells are routed out, as are the flaps and ailerons. What this means for the sailplane enthusiast is a minimum amount of work before getting the sailplane into the air. The wing is light but strong enough to take "pedal to the metal" launches. Also available as an option is Ron's unique internal capped hingeline. This means even less work for the modeler.

The fuselage is made by Steve Hug, owner of the Fuse Works. Steve is another master at what he does. Fuse Works makes what we consider to be the best fuselage in the business. Steve uses only the best fiberglass and Kevlar™ available. All fuselages are manufactured using the West Systems epoxy. Steve's fuselages have the least amount of pinholes, if any, that we have seen. In fact, the fuselage is so pretty that many people do not paint it. The fuselage is extremely light, and yet strong enough for very aggressive flying and landing. For those with very little building time, and those who don't like to paint, there is an optional pre-painted, in the mold, fuselage which includes a unique carbon fiber canopy.

All kitting is done at Slegers International's new and larger manufacturing facilities. We have spared no time or expense with supplying the modeler with the best materials available. The kit contains pre-sheeted wings and stabs by Ron Vann, fiberglass and Kevlar™ reinforced fuselage by Steve Hug, 3/8" diameter titanium wing rod from Kennedy Composites, optional 3/8" diameter steel wing rod by Squires Model Products, control horns and tow hook by Ziegelmeyer Enterprises, pushrods by Sullivan, or optional one piece steel rods. All wood is custom cut. Specially cut basswood of 60" is supplied to eliminate splices in leading edge, flaps and aileron capping. All balsa is hand picked, light to medium, to ensure light weight wing tips, stab tips, and rudder. Aircraft ply is used for the pre-fit servo tray and towhook block. A comprehensive instruction manual is included.

The Condor, designed by Mark Allen, wings by Ron Vann, fuselage by Steve Hug, and kitted by Slegers International, we feel, is the best open-class, thermal duration sailplane available, at an affordable price of $395.00 plus S&H.

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First Mosquito Class Winner Tomity and the TDKH trademark Charlie Brown RCHLG snagging tree, Showa Kinen National Park.

Forty one contestants - Buzz, far left, extricated himself from a hospitalization for ulcers to CD the contest.

Gogai! Gogai!! Extra! Extra!!

Mosquito Class Declared!!

By Dr. Paul Clark
Osaka Fu, Japan

The Fourth Annual Joe Wurts RCHLG Cup Fly, Tokyo, Japan is now history, and this year's contest made modeling history, again. The Takatsuki Open Field Flyers, TDKH (Takatsuki Denpata Kaku Han), have introduced the Mosquito Class RCHLG, 750 mm wing span, to our RC soaring world. Nobusuke "Buzz" Tokunaga, ringleader of the TDKH guys, said that it was "atarimae" or inevitable that it would happen, because of the way our RC gear has been developing. "Someone would have done it if we hadn't!" Nevertheless, it has been a determined effort on Buzz' part to find a way to put more fun, as well as maintain and create more interest, in RCHLG in Japan. This was considered a critical contest for RC soaring in Japan, as the soaring community has been prospering on the basis of RCHLG "mania" (what the RCHLG BOOM that followed the first contest was called), and needed a healthy boost. With the introduction of the Mosquito Class, the contest was a great success and will surely continue to prove itself as having been so, as it sparks interest on the international scene.

From the start, the contest has drawn participants from around Japan who wanted to stay in touch with what was happening and be a part of it. Weather was a contributing factor, as the very mild December, winter day added to the conviviality of the event. The walk back to the parking area as the sun was going down was as nice as the walk to the flying area in the morning. Still, the air, for all the fairness of the day, was rather flat. This, however, was more of an equalizer rather than a disadvantage, giving the contestants up to their piloting skills and not to chance. It also made possible a good comparison between the traditional 1.5m RCHLG Class and the new Mosquito 0.750m Class. Double entries were encouraged and eleven of the thirteen Mosquito Class entries participated in both, insuring a good showing of the best fliers competing in the new class. Not surprisingly then, the winner of the Mosquito Class and another pilot scored three perfect rounds each in the traditional Open Class and would have placed 1st and 2nd in Open if accumulated points had counted in the fly-off.

Three rounds were flown in the Mosquito Class:

- 1st round - beginning from 10 seconds, the most flights, with each flight time progressing five seconds,
- 2nd round - five best flight times, one-minute maxes,
- 3rd round - total flight time, ten point penalty for every launch, and
- All rounds - seven minute windows.

The Open Class flew similar rounds, but with two-minute maxes and ten-minute windows, as well as an additional fly-off round for the top ten (the task being the longest flight); both classes had unlimited throws. Thus, as the tasks were basically the same, good comparative data was accumulated; the top four in each class, as well as each round, were used for calculations.

As those who know will immediately recognize, flat air in this case was not dead air. In the Mosquito Class, first round pilots for the most part reached 45 seconds or scored 8 flights, while in the Open Class most pilots reached 55 seconds for a 10 flight score.

No doubt, however, the information of

Toshihiko Tomita holding wing cover scribed Mosquito.

Hiroyuki Haba pioneered RCHLG in Japan. This design appeared in the pages of RC Technique, November 1989 (810mm and 125g); here, 750mm and 85g with today's macro servos.

Kyohara Arai, 130g and very HL appearing, placed 2nd.

Koichi Takasaki cute effort at 105g makes a cup noodle look big!!

Shigeo Michiyama, 130g - top ten F3B pilot, crashed out the 1st round so didn't get to see the potential of this mosquito.

Sky Pilot, Paul Clark, grunting for a hand catch (Tomity's Mosquito). These little babies drop like a Zagi on approach!

interest to most is the average duration times of the second round. The Mosquito Class averaged 42 seconds per flight, there being but two maxes; the Butterflies averaged 1 minute and 5 seconds per flight, with yet only three maxes - tough day, especially on egos, maybe. In this round, the 750 mm class pilots managed to garner 3.5 minutes of flight time out of their 7-minute window, and the 1500 mm class pilots, 5.5 minutes from their 10 minute window. (For statistical purposes, the best five flight times were counted in the Open Class here, only four in the contest.)

In the third round, accumulated flight time task, the Mosquitoes averaged 6.5 minutes with an average of 9 launches, 7-minute window; and the traditional RCHLG's average fell just short of 8 minutes, with the same 9 launches, 10-minute window. As should be immediately evident, the Mosquito Class compares very interestingly with its counterpart. Indeed, it was a sky full of 3-5 ounce soarers (flight groups all day consisted of ten or more pilots) making similar times to their 8-13 ounce first cousins, especially in accumulated scores.

These comparative statistics should encourage anyone who has had a thought of venturing into this full-of-potential, smaller world of RC soaring. Don Stackhouse, the D of DJ Aerotech (Monarch, Chrysalis & Wizard) said, "Guess I'd better find some time in the schedule! I've been thinking for quite a few years how nice it would be to have a viable small sailplane that could fit, TX and all, into a briefcase that meets the requirements for under-seat luggage on the airlines... And this new class just might be the 'shot in the arm' this concept needs." Enough said, but there is much more to encourage giving it a try! Any ole' arm can launch a Mosquito 20% higher than the typical RCHLG - seriously - and the difference in weak thermals and flat air is enough seconds to make it MORE fun.

The tendency of the strong-arm flinger to give it all he's got only ends up with a badly scared Mosquito and a diaper change for the pilot. Give it a vigorous toss like you would a folded paper plane and it is topping out above everything else. Putting it in Phil Lontz' terms, let's call it the Lontz Grunt Gauge, on a scale of 10 where 10 hurts and a 6 will put it into lift, a 3 at best is all you need in this class - great altitude with little effort! Put a hook on one of these and you can launch it with a rubber band on a stick - odes of a childhood past!

That is not all!! This IS the small field, football field, park, back yard or front yard soarer, par excellence! It is like radio control hand launch - the ole' balsa and ambroid days. (What about those formed foam HL gliders we are already seeing!?) One flier was flying his 750 at the contest, outside for the first time! He claimed he had never hit the ceiling where he flew indoors. (We are seeing a lot of field house domes going up in Japan because of our long summer rainy season; 4 hours private use for $200.) He said he was getting a consistent 30 seconds on his flight times. These mini's will cause more than a few to dig back into the HL, FF and indoor designs for hints - for a couple, these birds like longer tails and shorter noses!?

A lot of credit for the success of the Mosquito Class premiere must go to Buzz' sidekick, Tomity (Tomita), and it is fitting that he handily won this first Mosquito Class contest. Buzz initially built a 750 with a Jedelsky wing; kind of a proof-of-concept experiment. From there they have ended up with what Tomity calls his "Mosquito 750". He has cut and given away well over 60 wing cores now with a, "Here! Go see what you can do with this and let me know back!" It sounds like the way John Lupperger entrepreneured the first ISS RCHLG contest with the original Gnome! The effort has been going on over the year since the last JWCF and the appeal and response was very evident in all the builds that showed up for the contest. The Selig airfoils are popular starters for the appearing variants, with all these "jisaku" or scratch design/builds, the SD7037 and S4083 in particular, but Tomity is cutting SA 7036 cores.

Continuing on, as the "Mosquito 750" gives us a common reference for the whole class, it has a wing chord of 150mm and a flat midsection (i.e., 180mm-390mm-180mm) with a straight trailing edge; the tips are tapered back to 110mm from the break and raised 50mm at the tip; it is planked with 0.8mm contest grade balsa. The leading edge is merely CA'd and sanded. For incidence, the wing was raised 5mm back, 25mm from the leading edge. It has a butterfly tail (110 degree), 2 x's 150mm by 100mm including elevator - a little larger than most, but was increased to correct the CG. The fuselage is a 6mm carbon boom and a pod of 0.8mm plywood and balsa, the width accommodating the servos; the fuselage length is 690mm, the tail moment being 290mm.

Tomity's "Mosquito 750" weighs 130g or 4.6 oz. The average of the little soarers at the contest was 112g or 4 oz., with a range from 85g to 148g, or 3-5 oz. The stripped Rx has become the rule in RCHLG, but these guys find ways to take off a few more grams, turn crystals and pins around for straight on plug-ins, all to serve lightness; Tomity's Futaba FP R113F is 11g! Increasingly, the lithium battery is coming into use; Tomity has been flying for a year on the same CR2, 23g battery. The popular

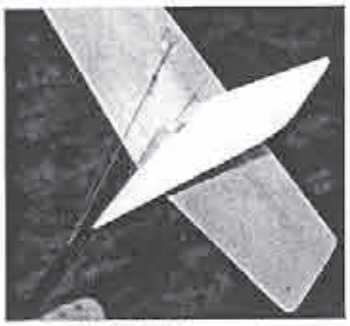
Shigeru Ryugo, heavy at 148, short tail moment - excellent times in the second round including a max; placed 3rd.

Shinichi Nakamura, 98g, good times, but crashed out last round.

Tomity truck'n for the flying grounds.

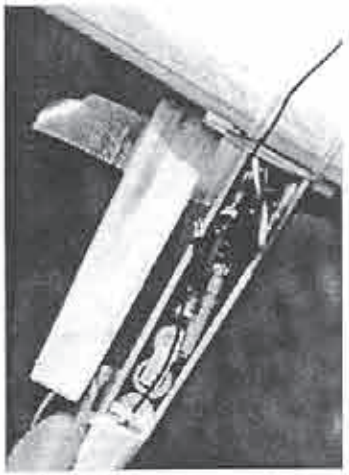
Curiosity was high among participants as they studied each others designs.

servo is the generic one of many names sold in Japan under the "Union" label, and twice as expensive as Hobby Shack. Typically, the antenna is snaked around the wing, or down the fuselage and back around... Most used fine piano wire for linkage; but a couple were push-pull - the super light one was.



Shinichi Nakamura's pull-pull tail system.

Tomity cutting another set of 750 cores. Buzz' hangar loft after the contest.



Koichi Takasaki - open canopy.

TDKH, Buzz and Tomity, have come up with a winning concept in the Mosquito Class, an idea whose time has come!! The Torrey Pines Gulls, Land of Poway and the IHLGF, have thrown a book of tasks at us to make things more interesting and challenging (they even fly "wingspan of your choice" Open Class contests), as a direct result of an overabundance of action at their thermal infested flying center. Here, in Japan, we fare even worse than our Midwest & Eastern USA brethren, it would seem, for decent RCHLG thermal action, and the Mosquito Class has been developed to put more soaring FUN into our flat air for us. All manner of creativity is breaking out - some pretty, some ugly, ALL fun!!

The ad hoc committee for RCHLG in Japan met again after the contest at the family restaurant Jonathan's, and called the dates for next years projected calendar of contests: June 6th, August 1st, and the 5th Annual Joe Wurts RCHLG Cup Fly, December 5, 1998; and if we are able and Joe is willing, he will be joining us for next year's Mosquito bash!! Come join us! We already have a possibility from Sweden! ■

Handlaunch Glider Wing Lay-Up Techniques

By Jeff Naber
Tulsa, Oklahoma

Recently, I began building my first self-designed handlaunch glider. I decided I would try vacuum bagging the wing. Never having glass bagged anything before, I decided I should find out what techniques most people use. I put out an e-mail on the Soaring@AirAge.com e-mail list for information and got a few responses, but not enough to really satisfy me.

The next action I took was to check all the handlaunch manufacturers web sites for lay-up information or articles. Unfortunately, I could find none that described their lay-up technique. I guess I was a little naive thinking a kit manufacturer would reveal their secrets for bagging wings. While surfing these various pages, I visited Chris Boultinghouse's "CAB Designs" page. I noticed a note stating he was no longer offering kits. Ah! Pay dirt! I figured he might be willing to divulge his secrets since he wasn't relying on them for his livelihood any longer. I sent off an e-mail asking for his assistance and expressing that I thought maybe no one was willing to give away their secret techniques and he replied, "Heck, I'd tell you even if I were still making kits! Doesn't bother me a bit." With his permission, I am paraphrasing the information he provided willingly to me.

For starters, the foam you use, be it gray, blue or pink, doesn't really matter. You want to put a 1" wide strip of 3 oz. glass cloth on the leading edge of your cores with 3M77 contact cement. If you are a masochist you can use Kevlar™. This gives you something to trim the skins back to and reinforces the leading edge.

Your mylars should be .014 Dupont Mylar. This is said to be the best mylar to use. It will not make a small radius bend like around the leading edge. This is not a problem, because the excess epoxy will fill the void and can be sanded to shape. If you use a thinner mylar, you will get "waves" in the wing and run the risk of getting wrinkles from the bag, transferring to the lay-up. The heavy mylar gives you absolutely beautiful wings.

Use one layer top and bottom of biased weave cloth, with the grain running span wise with the wing. This cloth should be 1.5 oz. plain weave. Make a diamond shape out to about 1/3rd of the span from .3 oz. carbon matt for the top and bottom. Unidirectional would probably be fine, also.

Prepare your mylars by waxing with Johnson's paste wax. Yes, it's made for floors, but it is dirt-cheap. Carnauba works okay, but is difficult to paint over. The Johnson's takes paint better. Polish the mylars, two coats worth at least, but don't rub it all off.

Paint the mylars top and bottom. If you don't, you will have a bazillion pinholes. It doesn't hurt the aerodynamics, but the first time you fly on a dewy morning it will suck up water like a sponge. The plane will weigh an once more after the first landing. Besides that, naked airplanes are ugly! Paint the mylars with Krylon. Save yourself the time and effort and use the Krylon. Other paints just don't work as well. Mist on the first few coats VERY lightly; more of a dusting than a full coat of paint. Be careful, too thick and it will "fisheye". Once these initial coats tack, you can build up more paint. Paint only enough to make the coating opaque.

Lay the dry glass cloth on the painted mylars and roll the epoxy on with a West Systems foam roller. Saturate well, but don't use so much that it puddles. You are looking for a uniform satiny sheen when looking across the lay-up. Next, lay the dry carbon matt diamond in place and roll it out without adding additional resin.

Now, bag this as usual. This should be pulled to 21" hg if possible. If you can't pull as high as 21" hg, anything over 15" hg should be sufficient.

Using these techniques, Chris said he could build a Corn Dogger wing that has 330 sq. in., with full paint top and bottom, at just over 4 ounces finished weight. ■

"SHORT CUTS"

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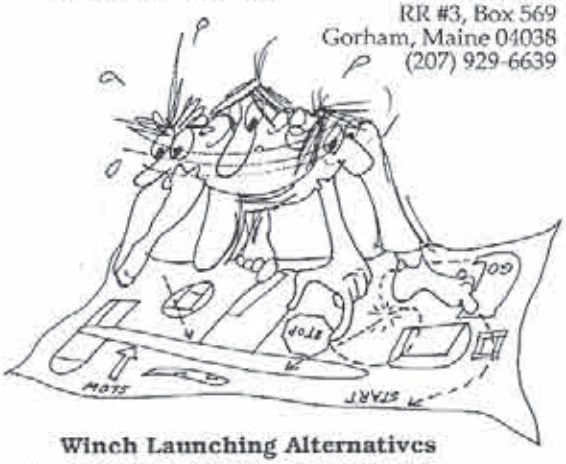


Winch Launching Alternatives

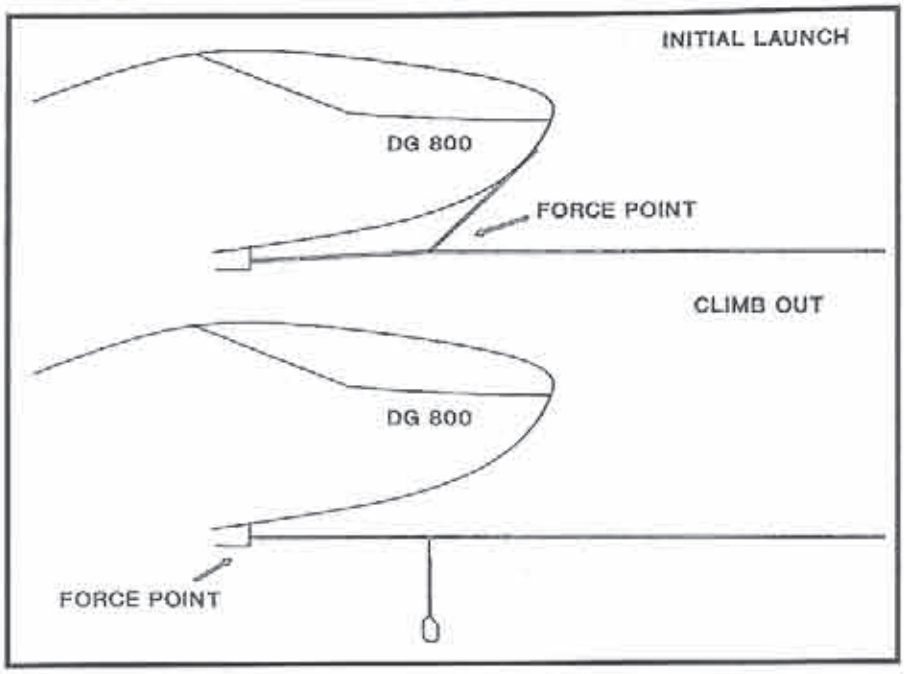
Last year, I acquired an EMS DG-800 from Sailplanes Unlimited Ltd., and have been very pleased with its performance. The plane has been flown exclusively via aerotow, even though I was told by Robin Lehman that its 4.2 meter span could be easily winched. The HQ 2.5 14 airfoil wing is fitted with flaps and full length ailerons that extend into the wing extensions. Sal Iasilli of Long Island owns a DG-800 and has both winched and hi-start launched his plane without any problems. Sal recommended lowering the flaps and cambering the ailerons for launching. He also placed the tow hook on his plane inside the retract bay just 3/8" forward of the aft edge of the doors.

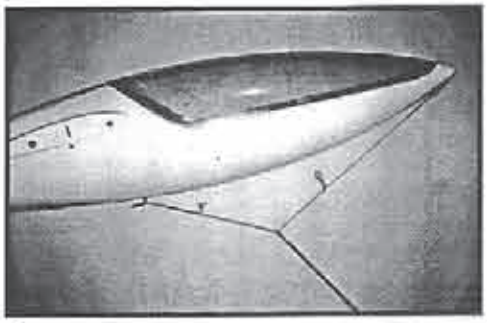
I removed the retract unit from my plane and glassed the doors shut with 6 oz. glass reinforcement and a 1/2" x 3/16" strip of poplar inside the fuselage. I placed my tow hook on the forward edge of the retract bay to start out on the conservative side. Even still, I didn't have the nerve to hand toss this scale beauty at the end of a winch line, so I set up a tow bridle which gives me two towing locations, one for the initial toss and the other for climbing out once the plane is at flying speed. I got this idea from my flying buddy, Jim Armstrong, who was contemplating the same set up for his 4 meter ASK-21.

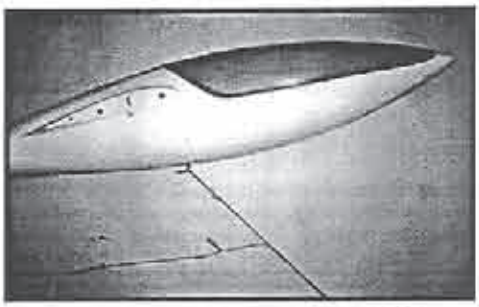
The bridle was made from 300# winch line, with an eye at each end and several in the middle. One eye is fitted into the nose release and the other attaches to the tow hook. The eyes in the middle serve as the attachment point for the winch line. The initial launch is made with the bridle attached to both the hook and nose release and gives a conservative launch. Once the plane's up to speed, the nose release is activated and the winch line is pulling directly on the tow hook.

I may eventually do away with the bridle, or place the tow hook in a more aggressive position and still use the bridle for the initial toss; either way, it works just fine. Not all scale ships take a winch launch well but, if one were to try it out for the first time, I would recommend the bridle method I just described.

Happy Winching! ■







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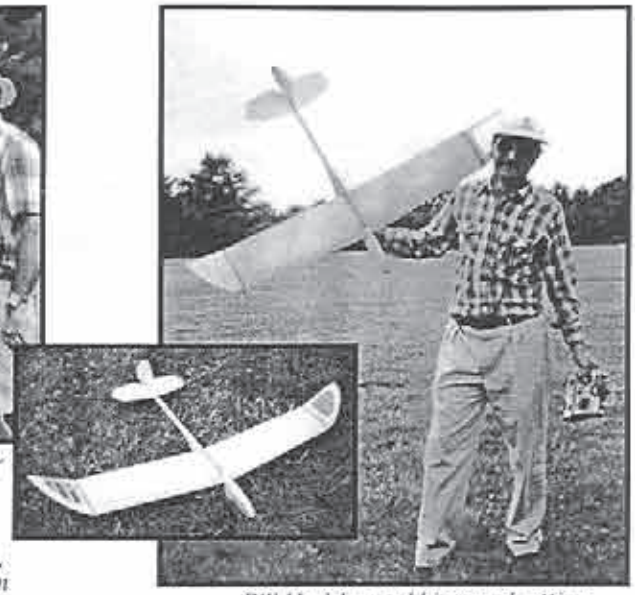
Most of M.O.S.S. was on hand for the record attempt. (L - R): CD Don Harris, timer High Rogers, Travis Hall, Bill Hoelcher, Chip Willis, Phil Pepin, Andrew Nagel, R.C. Yunker, Paul Wiesse, and Tom Nagel. Camera was on autopilot.



Bill Hoelcher and his record setting handlaunch plane, Cosmos.

Special Report
September 13, 1997 Columbus, Ohio

Central Ohio Flyer Sets New AMA Class A (HLG) Thermal Duration Record

Home Built, Low Tech Plane Adds a Half Hour to Thornburg Time

Article by Tom H. Nagel
Photos by Phil Pepin

William Hoelcher, of Westerville, Ohio set a new AMA record for thermal duration with a handlaunch glider, surpassing the old 1:40:39 record set by Dave Thornburg in 1992.

Bill flew his home-brewed handlaunch "COSMOS" to a new record of 2 hours, 8 minutes and 39 seconds (2:08:39) in an AMA sanctioned attempt on the Class A thermal duration record. CD was two-time LSF Level V member Don Harris; official timer was Mid Ohio Soaring Society (MOSS) president, Hugh Rogers.

The record attempt was a team effort by members of the Columbus area sailplane club. In addition to pilot Hoelcher, CD Harris, and timer Rogers, club member Phil Pepin acted as spotter, and members Paul Weisse, R.C. Yunker, Chip Willis, Travis Hill and Tom Nagel kept planes in the air looking for areas of lift. R.C. Yunker, a new flier, found lots of lift and, while the record attempt was in progress, put in a 30 minute flight and a 56 minute flight on his first ever sailplane, a 2-meter Spirit. (The author couldn't find a thermal all day and had to settle for duties as scribe.)

Bill Hoelcher never needs much help spotting lift, however, and flew most of the flight at extreme altitudes on a day marked by light winds and plentiful fair weather, cumulus cloud formations. At one point well into the record attempt, Bill lost sight of his model because of extreme altitude. He put the model into a spin and called for backup in locating it. Spotter Phil Pepin recovered sight of the plane with plenty of altitude and the attempt continued to a successful conclusion.

The record-setting flight ended only after clouds had closed in completely and thermal activity had shut down for the day. Bill spent the last twenty minutes or so under 200 feet scratching for altitude in extremely weak air.

Bill's record holding plane, the "COSMOS", is a highly modified, two channel Monarch of mixed construction. The inboard wing panels are DJ Aerotech Monarch seconds, bought from Joe Hahn at a Dayton Area Thermal Soarers' event. The outboard panels are of built up construction of Hoelcher's own design. Wingspan is just under 54 inches; weight is 11 3/4 ounces.

The plane features a conventional rudder and elevator configuration, with a balsa pod and boom fuse, the boom being a piece of L.E. stock like that used in a large power plane. The Sullivan push rods are glued to the outside of the boom.

Power was provided by a 270 mah Sanyo nicad pack. Bill figured it was good for about 2 1/2 to 3 hours, and that he had only 20 minutes or so of battery left when he landed. He had been throwing for about 30 minutes when he hooked a thermal and started his record attempt. Servos were two, twenty year old, World 22 micros. The receiver was an RCD535, and the transmitter was a simple, Airtronics Vanguard 4 channel FM.

What does a fellow think about while trying to keep a HLG aloft for better than two hours? "Losing my plane, mostly," Bill said. "I was flying it right at the limits the whole time. You've got to be at the fringes of visibility—otherwise, you can't wait out the cold air that blows through or make the distance between thermals."

"There are so many variables, though, that the airplane is the least of the elements. Weather, terrain, wind, available lift and luck are all bigger factors than the airplane. We hit a lucky day."

Bill believes that his two hour, eight minute flight is far from unbeatable. His prescription for a record HLG flight in the area of three hours, includes a stable plane, a lithium battery, a day with strong lift and light wind, and a pilot with good eyes and a strong bladder.

Bill says that one thing he remembers about the flight is that another club member, Chip Willis, kept coming over to ask Bill where his plane was. Each time Bill would point it out, and Chip would finally, with some difficulty, find the tiny flyspeck among the clouds. And each time, Chip would say, "You're crazy!" And then, walk off.

"He's probably right," Bill said. "I was totally shot at the end of it. The next day I felt like I'd been hit by a truck."

■

Jim Blum (U.S.A.) towing Gerry Knight's (Canada) Olympia 2b. Tug is a much modified Sr Telemaster.

The Greater Niagara Area Thermal Soarers (Gnats)

Scale Aerotow & Fun Fly

By Gerry Knight
Ontario, Canada

This was our second international event, held at our Wainfleet field on August 15-17 and, once again, proved to be a popular venue for scale sailplanes, tugs and motorgliders. Unfortunately, the Niagara weather turned a little fickle for us after having five absolutely perfect weekends prior to the event.

On Friday, the wind started to blow, heralding a change from warm day conditions in the 75° F range, to hot, humid, windy conditions. The day was spent getting the field ready, with tapes and stakes marking out the parking and pit areas, etc. The tents for transmitter compound and registration could not be put up due to the high winds. The Johnny-on-the-Spot arrived on time, which turned out to be the main event of the day. A couple of hardy souls tried to fly small electric gliders, but gave up eventually as the wind persisted all afternoon.

Saturday arrived and so did the majority of the pre-registered participants coming from the US and the Golden Horseshoe area around Lake Ontario. Sailplanes and tugs were unloaded and assembled; then began the long wait for the weather to improve. Unfortunately, the wind continued unabated through the afternoon and along came rain showers from a very ominous looking sky. Two large electric sailplanes flown by Phil Soden and Manfred Ecberger respectively, of the Oakville Club, made a couple of flights, but decided that discretion was the better part of valor and gave up before any damage could occur. The only other things that moved on Saturday were the hamburgers, hot dogs and soft drinks, which were devoured throughout the day.

By 3:30 pm, we were pretty well forced to pack up, as the wind continued to strengthen, finally blowing down the awning over the concession stand. A number of the participants from both sides of the border retired to the local motel and restaurant to drown our sorrows over some cold beer and to commiserate over the foul weather. Then, we sat down to a nicely prepared supper and enjoyed general conversation which naturally centered around aerotowing, tugs, engines and scale sailplanes. Our US friends, John Derstine and Jim Blum Jr., were very interesting to listen to; they talked about their activities relating to the early days of aerotowing with their mentor, Robin Lehman.

On Sunday, the sun came out and the wind moderated considerably, so after breakfast at the motel we headed for the field and got everything out again. This day proved to be our saving grace. Unfortunately, some of the registered pilots had packed up on Saturday and did not show up again, which was a great pity, for those that persisted into Sunday were rewarded with nice towing weather. John Derstine, Jim Blum Jr. and Ron Wahl spelled each other, doing a superb job of towing everyone who flew to great altitudes where there were lots of thermals. Quite a number of pilots were getting 30 to 45 minute flights after release, without any effort. These 3 guys flew their hearts out all day, using modified Telemasters and a scale Wilga tug.

There was a good mix of sailplanes, including vintage and modern ships, both ARF and scratch built. Most were 1/4 scale, along with a few 1/5th scale. Noteworthy among the vintage machines were Bill Woodward's Slingsby T-46 and Jim Blum Sr's Scheibe "L" Spatz, both of which performed beautifully. Fred Freeman's "Bergfalk" and Bill Woodward's Slingsby T-33 also put in some nice flights, as did your scribe's Olympia 26. K-18's were well in evidence and put in some beautiful flights, with Ron Wahl staying up for over an hour for the longest flight of the day. If you want a no nonsense, easy to fly sailplane, this is the one to buy; kits are available from Robin Lehman's Sailplanes Unlimited, Ltd.

In the modern category, we had two newcomers to scale aerotowing, with Stan Shaw flying his new HP 18 V-tail sailplane, and Charlie Rader flying his Multiplex LS 7. Both planes put in some nice flights. Considering the thick grass on the field, these two fellows made some nice takeoffs for their first aerotow experiences; they are firmly hooked on this method of launching. Stan's HP 18 is a particularly beautiful machine to watch in the air, with its slender fuselage and V-tail.

Pilots Choice awards were given out for Best Vintage (Bill Woodward's T-46), Best Modern (Stan Shaw's HP18), and for Best Scale Tug (John Derstine's Wilga). Spectators came out in droves to see this event and, considering the field's location way out in the "boonies", says a lot for our growing sport. What promised to be a bad weekend actually turned out to be quite successful; even the concession booth was a sellout!

Those who did not stay to fly on Sunday had brought some great looking ships, but unfortunately did not get the chance to show them off and get some great flying in. These included a very nice Grunau Baby by Jack Nunn from the Central Ontario Glider Group, and a nice 2m span Slingsby (Kirby) Cadet by Fred Freeman. This latter glider was drawn and scratch built by Fred, and the plans are offered for sale by him. This glider is also the basis for a one design type, club project; I believe that there are 8 currently being built.

I have to thank our American friends who showed up and virtually took over the towing for us. Without participation from people like John Derstine, Jim Blum Jr. and Ron Wahl, this event would not have been the same. We missed Robin Lehman at this year's event as he was in Europe, probably attending a similar event. To those who missed out this year because of the weather, cheer up; there is always 1998 to look forward to, and plenty of time to get those large scale sailplanes built for Elmira and our scale Fun Fly. ■

Gerry Knight, sitting down on the job!

Phil Landray & "Grob" in foreground. Bill Woodward and Slingsby T-46, rear. Photo by Ed Plowes.

Front to back: Slingsby Cadet by Fred Freeman, Slingsby T-46 by Bill Woodward, and Grunau Baby 2 by Jack Nunn.

(L) Wilga tug in foreground (John Derstine), HB2034 Scheibe SF28A motor glider (Gerry Knight), "L" Spatz glider (Jim Blum Sr.), and Telemaster tug (Jim Blum Jr.). Photo by Ed Plowes.

Scheibe SF-28A Tandem Falke (foreground) and E.O.N. Olympia 2b (rear), both 1/4 scale by Gerry Knight. Photo by Ed Plowes.

Wind Tunnel Tests of Wing Profiles

...by Martin Simons
Stepney, South Australia

(An expanded version of a talk given at the LSF Conference held at Jerilderie, New South Wales, Australia, Easter 1996.)

Part VIII

The new profiles

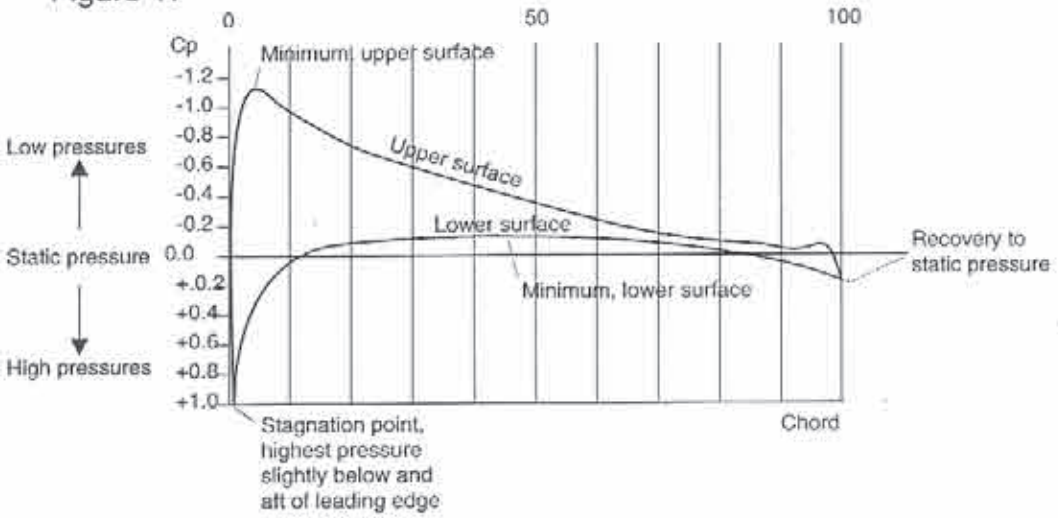
Anyone can design a new wing profile by drawing nice curved lines round a boot sole or cobbling something together by combining the upper surface of one wing section with the lower surface of another, or some other bodging procedure. Study of the Princeton and UIUC volumes should convince us that these crude methods have nothing in their favor. The marriage of unrelated upper and lower surfaces is based on the misconception that the airflow below the wing is independent of the flow above.

Air is fluid and a change in one place alters the flow both ahead and behind. An alteration in any place works its way right round the wing, affecting both sides. To design a new profile the entire pattern of flow has to be taken into account. This requires advanced calculations.

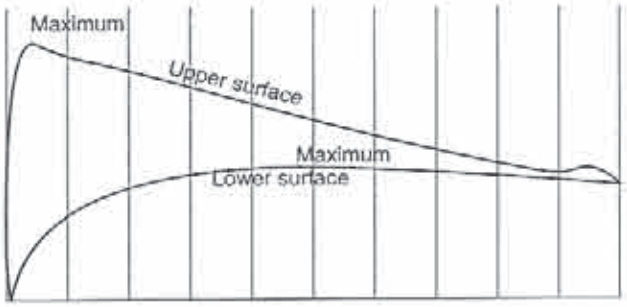
When the development of separation bubbles over perfectly smooth wings is studied in detail, generalising, it is found that they do not form so long as the flow velocity over the skin is increasing. There is, so to speak, enough force driving the laminar boundary layer along, to prevent any of it slowing down and stopping. The lowest layers are slowed by close contact, viscosity and friction against the wing skin, but so long as the mainstream speeds up, the boundary layer speeds up, too. But when the main flow begins to slow down, the lower laminae come to a stop very soon. They always move very slowly, so the least reduction in the force that moves them allows them to halt altogether. That is where the bubble starts, because the air following has to get by and it does so by leaving the skin, upsetting the layer above; this disturbs the next layer, and so on to the top of the entire boundary layer. This is laminar separation and a bubble forms with transition to turbulence thereafter.

The main stream flow over or under a wing will accelerate so long as it is moving towards a region of lower pressure (Figure 17). So long as the pressure is always getting lower, laminar flow will continue, providing the wing is not wavy or bumpy. As mentioned before, at the stagnation point the pressure is highest, so there is lower pressure further aft on both surfaces

Figure 17



Measured pressure variations over a wing profile at a lifting angle of attack.



Corresponding flow velocities producing the pressure variations shown above

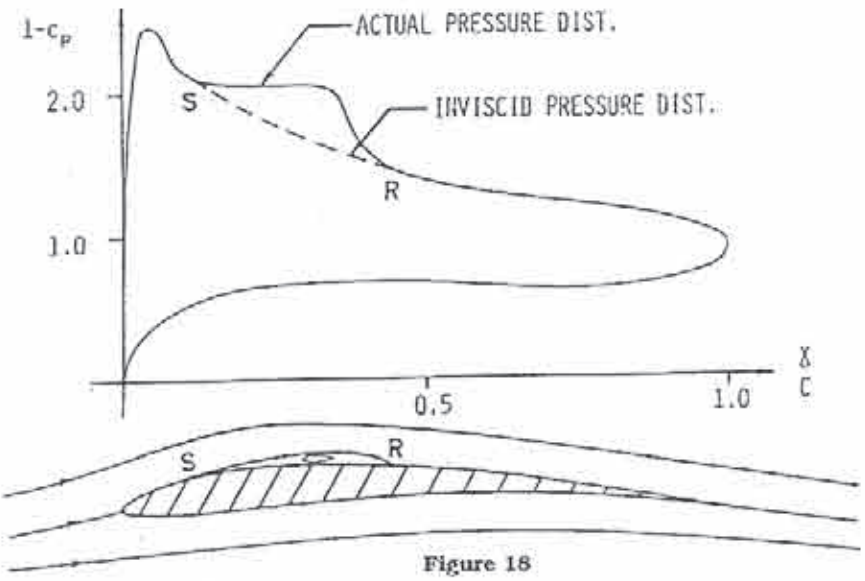


Figure 18

Characteristic pressure distribution beneath a separation bubble of the "short" type.

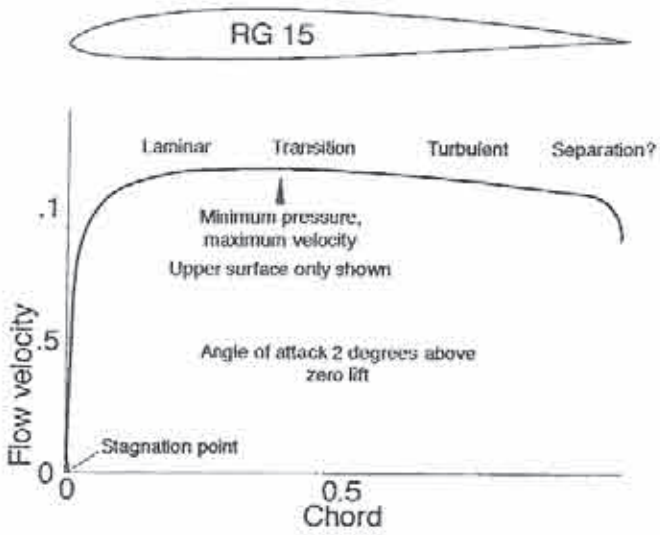
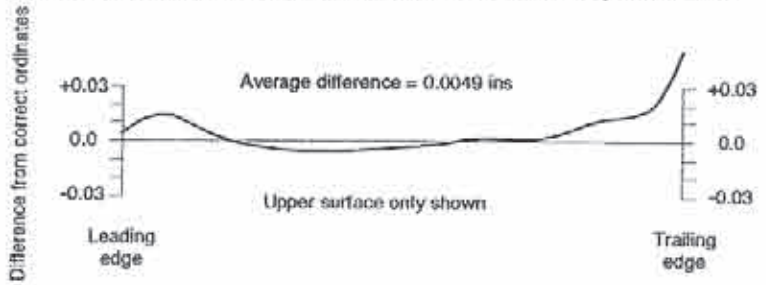
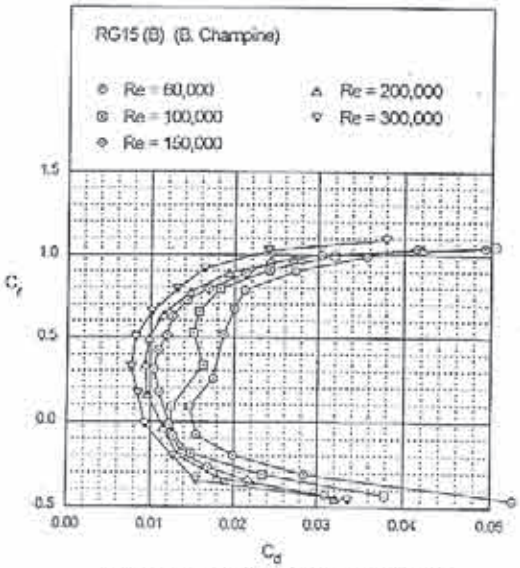


Figure 19. Flow velocity computed for the RG 15 wing profile on the upper surface only at an angle of attack of two degrees above the zero lift angle. Zero flow velocity exists at the stagnation point slightly below and behind the extreme leading edge. From this point velocity increases to a maximum, then begins to decline.

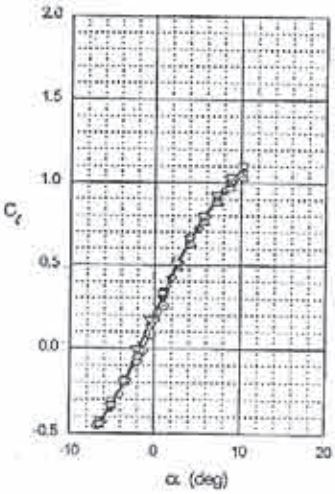
The diagram below is a plot of an actual wind tunnel model used in testing compared with the perfect ordinates. The computed velocity distribution will not be exactly achieved





Wind tunnel test charts at five Re numbers for the profile of figure 19.

FIGURE 21



of the wing, and the air responds by accelerating away from the high pressure point and laminar flow continues.

The pressure reduction is normally more on the upper side than the lower, which difference creates the lifting force, but it is important to note that the pressure on the lower surface is less than that at the stagnation point. Given a reasonably smooth skin, laminar flow exists on both sides to start with.

As shown in Figure 17, the flow velocity and pressure vary always together; a decrease of pressure causes, or drives, an increase in flow velocity, an increase in pressure slows down the velocity.

Unfortunately we cannot arrange a wing that works with steadily decreasing pressures and increasing flow velocities all the way to the trailing edge. Somewhere on the wing surfaces, the pressure will reach a minimum value and then it begins to recover. The flow will speed up, but then begin to slow down.

Thus, somewhere on the skin above and below the wing there will be points of minimum pressure, approaching which the boundary layer flow will speed up. But sooner or later it must slow down. It may already have been made turbulent by some sort of irregularity in the surface, but if the flow is still laminar, at the minimum pressure point a bubble will form. If it forms too far forward, the drag will be higher than desirable.

Most traditional wing profiles have a minimum pressure point on their upper sides, very close behind the leading edge. The result, for model aircraft, is that the separation bubble forms almost immediately and the boundary layer becomes turbulent (Figures 17 & 18). This may not be a bad thing, since the flow does not necessarily separate or stall totally, and such wing profiles are still useful for many ordinary models. They are not very low drag profiles, but they work quite well and give us few nasty surprises, excellent for sport flying and beginners' models.

But if the minimum pressure point can be arranged further aft, the bubble forms further aft and there will be more laminar flow over the leading portion of the wing.

But if a bubble forms very late, it may be too far aft and after separation the air may never have a chance to reattach, i.e., the bubble may burst, which will be a partial stalling with very high drag and poor lift. In such a case, the wing will be very disappointing and a good deal worse than the traditional turbulent flow sections.

What the profile designer aims for is delaying the formation of the bubble to retain laminar flow with its inherently low drag as long as possible, but ensuring that when the bubble does form there will be enough space for the flow to reattach and continue attached all the way to the trailing edge.

This cannot be guaranteed by drawing round a size nine boot or even a size eleven.

To produce a new wing profile, as Selig and his colleagues have done (following general methods devised by Wortmann, Eppler and others before them), the designer has to compute the flow speed everywhere around the wing, above and below, and try to control the pressure distribution everywhere. In fact, what is usually done now is to decide first what pressure distribution is required to get the desired flow velocities, and then, by a backwards iteration process, find the profile shape that will give this velocity variation. (It is of course possible to work the other way round: draw round the boot sole to obtain a profile, then calculate the pressure and velocity distributions and see if the result is any good. You might be lucky, but the chances are heavily against it.)

One of the mathematical devices used is to shape the

pressure pattern so that the change from increasing velocity (i.e., flow towards lower pressure), to slower velocity (flow towards higher pressure) is as gradual as possible, so that the lowest levels of the boundary layer will not come suddenly to a standstill, but will slow down very gradually, even moving a little way into the increasing pressure zone. This delays the formation of the bubble slightly and reduces drag a bit, when it works.

Taking this line of thought further, if the pressure distribution can be made to fall to its minimum, then to remain constant for some distance before rising (i.e., accelerating flow, constant speed flow, decelerating flow) again, there is a chance that laminar flow will continue at least some distance into the constant pressure zone. The trouble is that where the constant pressure zone finally ends, there is a relatively short distance remaining within which the pressure must increase rapidly to the static value again (Figure 19). Saving drag over the forward part of the wing is useless if the rapid rise in pressure aft causes separation aft.

If the pressure distribution can be such that after the minimum point, the return to static value is suitably controlled, using what is called by Selig & Co. a **bubble ramp**, the separation bubble when it forms will be small and the boundary layer will reattach without trouble. At least that is what is hoped for (Figure 20).

In all this work, the pressure distribution over both upper and lower surfaces has to be considered. It would be pointless to produce an upper surface which was ideal, if the lower surface had a huge separation bubble, or vice versa. Figure 17 shows how the upper surface velocity changes compare with those on the underside. Both surfaces produce a share of drag.

The design process cannot end here. A wing that produced ideal flow at only one angle of attack would not be of much value. If a model is designed to fly always at one speed, everything may be sacrificed to achieve efficiency at that trim, for instance for a free flight sailplane or, at the other end of the speed scale, a pylon racer. Even in these cases, though, things like launching and high speed turns have to be allowed for. For multi task sailplanes, slope soarers, hand launched gliders and so on, a profile which is to be of any practical use has to be designed to produce good pressure patterns over a reasonably broad range of angles of attack. At each trim in flight, corresponding to the position of the elevator of the model, the pressure distribution around the wing changes, the separation bubbles tend to shift, and a different set of conditions arises. Complication is added to complication and there is no escape.

Very approximately, these are the principles used by the Selig group to produce the new aerofoil sections. The outcome in terms of actual drag and lift figures in the wind tunnel, is shown in Figures 21 and 22. Those in search of more detail must refer to the published volumes. ■

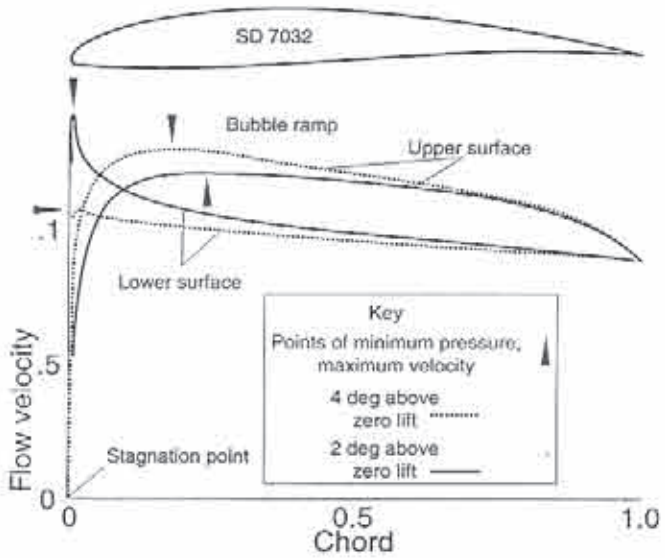


Figure 20. Flow velocities computed for the SD 7032 profile at angles of attack two and four degrees above the zero lift angle. Both upper and lower surfaces shown. Velocity on both surfaces increases, and pressure falls, aft of the stagnation point. Lift is generated because there is an average difference in pressure between the two surfaces.

The diagram below is a plot of an actual wind tunnel model used in the test compared with the perfect ordinates. The computed velocity distribution will not be exactly achieved

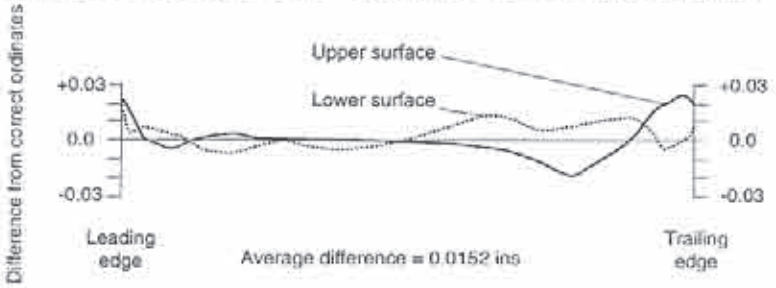
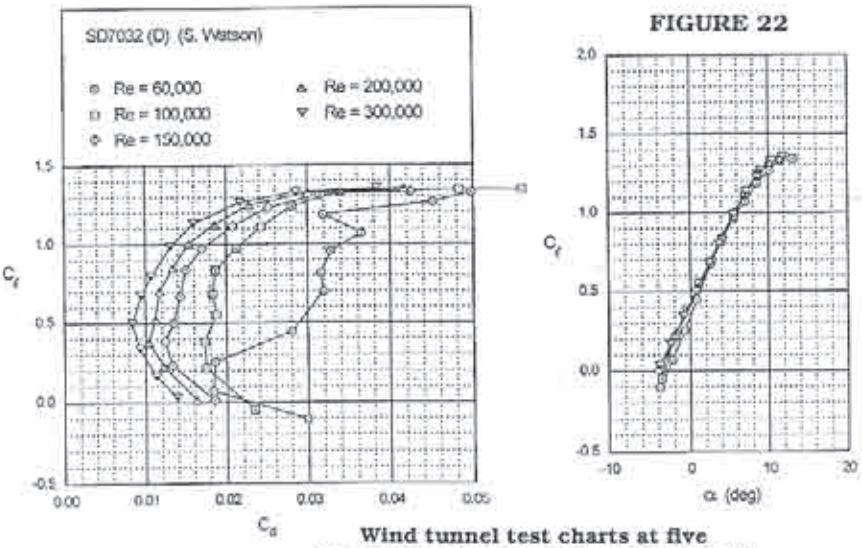


FIGURE 22



Wind tunnel test charts at five Re numbers for the profile of figure 20.

Part IX concludes the discussion with Turbulators. Ed. ■

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Across Country

By Don Pesznecker
Milwaukie, Oregon

The 6th and 7th of September, were the best days for x-country (XC) that we have had for 250 years. (I don't remember before that.) I have been flying, or at least going to XC events, for about 4 or 5 years; it was on the second year that I actually got off the field and on course for a short distance. When we would drive the course for familiarization, my team would look for landing places; not where the trees overhang or where the turns were. It was a rather dismal beginning. Then we started flying electric airplanes and things started looking up. The team could make it around the course with a gazillion batteries, but the mind set started changing. Now we knew we could make it, even when the sailplanes didn't. I must say this is a confidence builder. Last weekend we flew two different airplanes (electrics) on only 7 cells, and had the time of our lives. Greg Springate flying his Lasoar 650, on 7 cells with a total motor run of about 1 minute and 20 seconds, made so many trips around the course that I lost count. I was flying my Oly II on 7 cells and had a motor run of almost 6 minutes, making just as many trips. Saturday was one of those perfect days that you dream about. Everyone, that is all teams, made both the short and long courses; the thermals were frequent and predictable. The times around both courses were amazing for Team Kurash and Team Excellence. Our electrics were not even close.

Sunday morning looked just about as good as Saturday; maybe not quite, but almost. Knowing that I needed my 10K goal and return, Barry Kurath offered me his team and airplane to give it a try in the afternoon. The morning went well and I think everyone made their afternoon trips around the course, when Barry said it was about time to get going. I had driven the 10K course on the way to the field that morning, and it was about 8 road miles; I was thinking, "This is really a long way to go," and had much doubt about my abilities to fly a sailplane 16 miles. We launched and went on course; the first time we only got about 3 miles down the road when I was on the ground. Matt Brady was driving his Jeep and Barry was coaching; the trip back to the field didn't take long; it was back up the winch for another try. The thermal sniffer was not operating properly; Barry did more talking to it than to me. However, we got within a half mile of the turn. This was my longest XC flight ever, but is was a long ride back to the field. When we finally arrived, Mike Bamberg offered his RnR SB XC and his team for a try; of course, I accepted, making a launch and a short flight to get used to the airplane. Then we launched and specked it out for a go at the 10K. Craig Robinson was driving his PU, Bob Nelson was navigating and Mike was coaching, and yelling at me to stay on course, as I wandered around a bit. We got quite low a couple of times, but thermaled back up until I could hardly see the airplane. As a matter of fact, if Mike knew how often I couldn't see the airplane, he would have taken the transmitter away from me. I had no idea where we were, or how much time had gone by, when Mike told me to make my turn. Wow! We were half way to my goal. I made the turn and came down a bit, when we hit a nice thermal and, once more, specked it out. It seems that we were about 7 miles from the field; I don't think I made another thermal turn all the way back. When Mike told me to turn right and I lost it in the sun one more time, I recognized the trees and knew I only had less than a half mile to go. Which I did. The feeling of elation for completing the task is something I can't describe.

I can only offer my gratitude to the many people who made this flight possible. It seems the contest came to a stop while everyone helped me achieve my goal. I had my choice of XC airplanes and teams to complete it. The people in this club (Portland Area Soaring Society), once again, have proven why "it just doesn't get any better than this". ■

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It's a bird! It's a plane! It's a camera?

By Dave Grenewetzki
Novato, California

(RCSD received a brief e-mail from Dave, a new subscriber, asking if we'd like to hear about a "little" camera controller project he was working on. One look at the web site, and we immediately gave Dave the thumbs up. For those of you that can access web sites, you'll just have to see for yourself! We did wander into the gallery, as well, and noted some absolutely beautiful photography by John Raley of California. What follows is Dave's story; if any of you need more information, please contact him, as he may do a follow-up article if enough interest is expressed.)

This project began as an attempt to combine my two favorite pastimes, photography and radio control flying. The outcome and the path I took to get there was completely unexpected and gave me the opportunity to meet some new people, learn new skills and ultimately achieve the blending of two hobbies. This article is more about the process than the project.

I wanted to take aerial photos from a model plane. This seemed like a pretty simple goal, so I guessed that I'd take a couple of weekends, somehow get a camera mounted in a plane, and snap some pictures.

The thought of an expensive camera lying on the ground in a hundred pieces following a "rough" landing sent me first to the local drug store to look at disposable (or "one time use") cameras since they are both cheap (under $10) and plentiful. I found a number of good candidates, and guessed that I could easily rig a servo to snap a picture on command. Just one problem - the disposable cameras don't have an autowind feature. This meant that for every picture I wanted to take, I'd have to land, advance the film and get the whole rig back into the air.

As the next step, I investigated cheap autowind cameras. There were lots of 35mm cameras in the $40 neighborhood that would have worked well if they weren't all so big and heavy. I was looking for something that would be light enough to attach to just about any plane, but nothing seemed to fit the bill.

Just as I was about to give up and move onto another project, I got the idea of looking into the new class of reasonably priced digital cameras. A digital camera doesn't use film, but rather captures images electronically that can be downloaded into a computer, viewed on screen, "retouched" as needed, and printed on a color or black and white printer.

After looking over a wide range of cameras, I chose the tiny, lightweight Kodak DC20 for the project. Priced at that time at just under $200, this was more than I had originally budgeted. However, the thought of doing this entire project, with no moving parts, had a design elegance that intrigued me. Also, the prospect of being able to look at my pictures as soon as I landed was appealing. The DC20 weighs just over four ounces and is the size of a pack of playing cards. With a shutter speed of as fast as 1/4000th of a second, vibration blurring wouldn't be an issue.

In the DC20 kit, Kodak supplies the cables and software required to connect the camera to virtually any Windows or Mac computer. The included software allows you do download, view, modify, print and make presentations using pictures taken with the camera.

I had assumed that the camera would have some simple way to plug in a switch that I could flip to take a picture. This turned out to be a bad assumption. While the DC20 has a standard shutter release button on the top of the camera, it requires a serial data stream be sent to the camera to remotely trigger the shutter. For a moment, I panicked, as I thought I might have to crack open the case, solder in a couple of wires to the shutter release button to trigger it from my R/C receiver. That would have really been a kludge, would have voided the camera warranty and would have made the camera cumbersome for normal use. I decided to get on the Internet to see if I could find anyone who had already solved this problem.

Thirty Second Guide to the Internet: The Internet is nothing more than a bunch of computers all connected to each other. Major companies and a lot of individuals have chosen to make information about their products, services, hobbies and interests public via the Internet. A collection of this data for a particular person or company is called a "web site". Visiting a web site is like writing away for information, except that it shows up on your home computer instantaneously, and can include more than just printed materials. You can also access sound, movies, software programs and more. The collection of all of these interconnected web sites is referred to as the World Wide Web (WWW) and accounts for the hundreds of references you see every day for web sites like www.chevrolet.com and www.towerhobbies.com. As you'll see, it's a great way to get information on lots of topics.

My first stop was the Kodak web site, where I signed up to become a member of Kodak's registered developer's group. Kodak actively assists software and hardware developers who develop products that support their cameras. I downloaded a lot of helpful information, but they didn't have any details of how to trigger the camera in an application like mine.

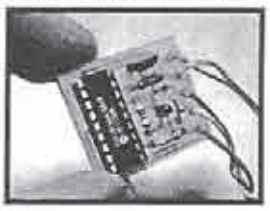
It was back to the Internet. Within a few minutes, I had found the "DC20 Secrets Page" by Oliver Hartmann in Denmark. Oliver had collected just about all the available information on the DC20 camera, including the codes that I needed to command the camera to snap a picture.

I decided to design a circuit to read a receiver channel servo output, look for the "take picture" command, and then send the appropriate signal to the camera. Although my background is in electrical engineering, it had been a long time since I had designed a circuit - I'd spent the last fifteen years making video game software.

It was back to the Internet to do some searching. First, I needed to know what kind of signal an R/C receiver sends to a servo, since I was going to have to decode that signal to determine when to take a picture. Again, in a few minutes, I had found a complete dissertation on how R/C systems work at Ahmet Onat's web site in Tokyo.

Now, I knew what the input data from the R/C receiver would look like and what my output signal to the camera needed to be. All I needed was that "little something" in between that would knit them together. It was once again back to the Internet for some general research. What I discovered was a class of electronic components called Peripheral Interface Controllers or PICs. A PIC is basically a complete computer on a single low priced chip that can easily be programmed to handle a variety of input and output. While the chips themselves are only about $7 each, I needed to make a $300 investment to get the software and hardware tools needed to write a program on my personal computer and program it into the PIC. After doing a feature comparison on the 'net, I settled on the EPIC PIC programmer and the PICBASIC compiler from MicroEngineering Labs in Colorado. My "weekend" project budget was fast approaching $600.

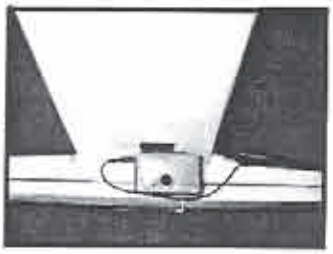
Luckily, the PIC chip did most of the hard work for me. I chose the PIC16F84, an 18-pin chip that uses EEPROM memory that let me repeatedly download my software into the chip until everything worked right. The PIC retains the program in memory even when the circuit is turned off. Not much support circuitry is required, just a couple of resistors, a capacitor, a ceramic resonator and a small circuit board. I designed my printed circuit board using Schematic Plus and PC Trace from EESoft, a product I found (you guessed it) on the Internet.



The program in the PIC chip is pretty straightforward. It accomplishes the following three major functions. First, it watches the servo command from the receiver, measures a pulse width and "decides" when to send the "take picture" command to the camera. Second, it sends a "camera initialization" command to the camera every minute to trick the camera's power conservation circuitry, to keep the camera from automatically shutting down to save power. Third, the software drives the LED indicator to give you an idea of what's going on with the circuit.

Once the circuit was assembled and tested, I used adhesive velcro strips to attach my camera to my plane, a 2 meter Thunder Tigre Windstar. Initially, I experimented with two mounting locations, both of which worked well. The under wing mounting location produces "straight

down" shots that have the look of aerial surveillance photos, while mounting the camera on the side of the fuselage, looking along the wing creates more dramatic looking pictures that include the horizon. The great thing is that the whole project (including the camera, controller and batteries) added just over five ounces to my plane.



During my first flight, the camera came loose and dangled from the signal cord under the plane for the duration of the flight. I tried to stay calm and took eight great pictures, even though they were a bit tilted due to the precarious position of the camera. To stop this from happening again, I covered the back of the camera with velcro to get a better grip and I haven't had any problems since. It was a tremendous thrill watching that first batch of pictures "develop" on my computer screen. Even my wife, who had suffered through a couple of weekends of me in "mad scientist" mode, was impressed.

Here are three pictures that show the variety of shots that I have managed to get by varying the camera mounting position. The first, from an under wing mounting position, looks a bit like the U2 spy plane photos.

Straight Down Aerial Surveillance View.

This photo is from a camera mounted on the fuselage pointing toward the right wing (which is visible at the top of the picture).

Oblique View from Fuselage Mounted Camera.

Recently, I've built a plywood bracket that allows me to position the camera just about anywhere. This view is taken from an over-wing, rear-looking position as the plane leaves the ground on hi-start launch.

Rear-facing View During Hi-Start Launch.

I decided that I should find a way to show the pictures to the world — so it was back to the Internet to set up my own web page. I bought Microsoft's FrontPage, a web creation program, and built a very simple web site that displayed a couple of my aerial photos and discussed the project. I then visited a couple of Internet newsgroups (like community bulletin boards) related to modeling and let people know that I was open for viewing. I also sent a note to the folks at Kodak to let them know that I was doing something unique with one of their products.

The response has been overwhelming. In the first couple of weeks more than 2,000 people visited my web site and now, several months later, that number is approaching 10,000. I got email from dozens of people asking if I was going to offer the camera controller commercially, so I've decided to give it a shot. I'm now selling a "solder-it-yourself" kit version, as well as an assembled and tested version of the camera controller. Another bit of good news is that the price of the Kodak DC20 has fallen considerably and is now regularly seen on sale for as low as $99.

Kodak has also taken notice of the project and has built a link from their web site to mine, which sends a lot of people my way. Also, I was interviewed by the Kodak PR department, which resulted in this project getting some great publicity in an official Kodak press release about interesting uses of digital cameras.

The newest addition to my web site is a large photo gallery of the best remote controlled photographs from my customers, as well as the best shots from other sites on the net. I've got pictures from power planes, gliders, helicopters, kites, robots and even rockets.

If you're interested in adding a camera to your glider, or any other R/C vehicle, please contact me. As you might have guessed, the fastest way is to use the Internet. On my web site, I've placed copies of the operating and building instructions for the camera controller, pointers to the best prices on digital cameras, lots of general information relating to aerial photography and a gallery of amazing aerial photos. For further information by mail, please enclose a stamped self-addressed envelope.

The kit version of the controller sells for $25 and the assembled and tested version is $50. US and Canadian residents must add $5 for postage, all others add $12 for international airmail. California residents be sure to add appropriate sales tax. All payments must be in US dollars drawn on a US bank. Specify radio type so we can include the right connector. I offer a $5 rebate for any customer who sends me electronic versions of their photos for use in my web gallery.

So if you see an R/C plane pass overhead — look up and smile — you may be on camera! ■

www.kodak.com
The official Kodak site has lots of information relating to digital cameras. Just follow the "Digital Photography" links from their home page.

home.t-online.de/home/Oliver.Hartmann/dc20secr.htm
This is the "Kodak DC20 Secrets" page maintained by Oliver Hartman full of interesting information related to the DC20 and related cameras. It's constantly updated as Oliver learns new tricks. Oliver also includes a number of links to other digital camera enthusiasts.

turbine.kuee.kyoto-u.ac.jp/staff/onat.html
I found Ahmet Onat's page while searching for information related to the signals required to drive R/C servos. His site contains a complete discussion of R/C technical issues as well as info on some of his robotics projects.

www.microchip.com
The manufacturers of the PIC processor line of products.

www.melabs.com
These are the folks that created the EPIC programming system and the PIC BASIC compiler that I used to program the PIC processor used in this project.

www.eesoft.com
I used EESoft's Schematic Plus software package to capture the circuit diagram for this project and their PC Trace package to lay out the PC board. Great software at a fair price.

www.kodak.com/daiHome/DC20/dc20Links.shtml
Kodak included a link to my web site from their DC20 information site.

www.kodak.com/aboutKodak/pressReleases/pr19970915-02.shtml
Kodak Press Release:
How to Use Digital Pictures.
This informative press release describing real world uses of digital photography mentions this project in great detail.

David Grenewetzki
P O Box 1091
Novato, CA 94948-1091
Email: dgreno@wco.com
R/C Aerial Photo Web Site:
http://www.wco.com/~dgreno

SCHEDULE OF SPECIAL EVENTS

Fayetteville '96, Lehman photo.

Feb. 15

GDS&HS Sno-Fli — Detroit, MI
Dave Corven, (248) 656-1879

Feb. 20-22
(raindate Feb. 27-March 1)

Pensacola '97 Scale/Airtow — Pensacola, FL
Asher Carmichael, (334) 626-9141
ACarmic985@aol.com

March 28

Torrey Pines Scale Soaring Classic — Poway & La Jolla, CA
Ron Scharck, (619) 454-4900, scharck@aol.com
Gary Fogel, (310) 838-6068, gfogel@ucla.edu

May 16-17

Los Banos Slope Scale Soar-In — Los Banos, CA
Lynsel Miller, (408) 275-6403

May 15-17

SIG/Lass Midwest Slope Challenge — Lucas, KS
Paul Wright, (402) 796-2175
paulw@isco.com

May 30-31

Sailplane Weekend — Addison Oaks Park, MI
Ray Hayes, (810) 781-7018, skybench@teleweb.net

June 11-14

Elmira Aerotow '98 — Elmira, NY
John Derstine, (717) 596-2392
johnders@postoffice.ptd.net

June 13-14

Land of Lincoln E-Fly — Springfield, IL
Tim McDonough, (217) 523-8625, tpm@inw.net
http://www.inw.net/~tpm

June 26-28

MSSC '98 — Louisville, KY
Ed Wilson, ewilson1@bellsouth.net

August 14-16

GNATS Scale Fun Fly — Niagara Peninsula, Canada
Gerry Knight, (905) 934-7451
Don Smith, (905) 934-3815
mistral@niagara.com, linden@niagara.com

Los Banos, Lehman photo.

Elmira '96, Lehman photo.

Outside U.S.A.
Aug. 1998
F3J World Championships, organized by BARCS

Pensacola, Lehman photo.

Closet Scale Stuff
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1/3 Pribek ASW 27 - 5 meter span (196"), wing profile HQ 2.5/12, ca. 20 lbs.

1/3 Müller Discus - 5 meter span (196"), wing profile HQ 2/12, ca. 20 lbs.

1/4.2 FiberClassics Nimbus 4 - 6.28 meter span (246"), wing profile E 68-66, ca. 18 lbs.

1/3.6 Roedelmodell DG 800 - 4.15 meter span (163"), wing profile E 207, ca. 11 lbs.

1/3.75 Roedelmodell Fox MDM-1 - 3.8 meter span (149"), wing profile RG 12, ca. 15 lbs.

1/4 Roebers Pilatus B-4 - 3.75 meter span (147"), wing profile Ritz 3, approx. 8 lbs.

1/4 Roedel Piper Super Cub (scale towplane) - 2.687 meter span (105"), wing profile Clark Y mod., approx. 15 lbs. This airplane is partially built. It requires additional building and covering. Suitable mtors are OS 160 T, OS BGX-1, Brison 3.2, or similar.

1/2.77 PriBek ASW 19 - 5.4 meter span (212"), wing profile Ritz 3 mod., ca. 20 lbs.

1/3 ASK 13 - 5.33 meter span (209"), wing profile E 68-67-66, ca. 32 lbs. Completely built & ready to fly with all servos installed, brand new, unflown.

1/3.5 Roke DG 202 - 4.86 m span (168"). Completely built including all servos.

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For additional information contact:
Gerry Knight, (905) 934-7451
Don Smith, (905) 934-3815
E-mail: Mistral@niagara.com
Linden@niagara.com

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 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).

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Classified ads are free of charge to subscribers provided the ad is personal in nature and does not refer to a business enterprise. Classified ads that refer to a business enterprise are charged $5.00 per month and are limited to a maximum of 40 words. The deadline for receiving advertising material is the 1st day of the month. (Example: If you wish to place an ad in the March issue, it must be received by February 1.) *RCSD* has neither the facilities or the staff to investigate advertising claims. However, please notify *RCSD* if any misrepresentation occurs. Market Place Listings are $5 a month.

Personal ads are run for one month and are then deleted automatically. However, if you have items that might be hard to sell, you may run the ad for two months consecutively.

For Sale - Business

PC-Soar Version 3.5 Sailplane Performance Evaluation Program Optional Sailplane Library now expanded to 54 models including: Alcyone, Anthem, Genesis, Mako, Probe, Thermal Eagle, and Synergy 91. Free Library Upgrades. PC-Soar Upgrade to Ver. 3.5 $10, PC-Soar New Purchase $40. New Libraries of Sailplanes and Airfoil Polars $30. Please include $3 P&H for all purchases & upgrades. Also available: Laser cut airfoil templates. LJM Associates, 1300 Bay Ridge Rd., Appleton, WI 54915; ph: (920) 731-4848 after 5:30 pm weekdays or on weekends; <http://www.athenet.net/~atkron95/pcsoar.htm>.

PRECISION AMAP WING CUTTER, replacement parts, and service. AMAP Model Products, 2943 Broadway, Oakland, CA 94611. Butch Hollidge, (510) 451-6129, or fax (510) 834-0349.

A.M.P. Aerial Model Products, sport, slope, race prototypes - all airfoils. 60" Del Valle Snake, 94" H&K Cobra, AMAP Flair, Kevin Cutler's full house Davenport Monitor. All race tested. Butch Hollidge, (510) 680-0589, eve, California.

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For Sale - Personal

Alpenia, flown once, white on black wing and stab color, white fuse, 160" span, obechi over foam, glass fuse, truly beautiful sailplane... $300.00 or best offer. You pay shipping. Ray Hayes, (810) 781-7018, Michigan.

Robbe kits, NIB + UPS: Kormoran... $95.00; Arcus... $95.00; Arcus Pro... $135.00; Speeder E... $75.00; SF 36L... $200.00; ASW-24... $250.00; Saphir Slope... $150.00; Saphir Thermal... $150.00; Calibra Pro... $175.00; Charly (Sky Diver)... $125.00. Craig Christensen, (612) 435-7406, after 4:30, Minnesota.

2m Banshee, incl. 6 servos, painted (blue) wood carry case (very strong), blue & yellow... $275.00; 100" Dodgson Saber, incl. 5 servos, painted (red) wood carry case, white... $250.00; Airtronics Legend, incl. 6 servos, painted (red) wood carry case, white/red... $300.00; Airtronics 600 trans, receiver, battery pack, no servos (they're in Saber)... $200.00. Prices do not incl. shipping. E-mail direct for more info. Cases hand made from mdf particle board; painted w/auto acrylic paint, hinged w/clasps & leather handles. Wings & fuse are cradled inside w/cutouts. Planes in good shape. Bill Heishman, (972) 642-3355, <billh@computek.net>, Texas.

1/4 Roebers Pilatus B4, 3.75 meter span (147"), wing profile Ritz 3, NIB... $495.00; 1/4 Roedel Super Cub (towplane), 2.687 meter span, wing profile Clark Y mod. (suitable motors are 160 T, 300 T, OS BGX-1, Brison 3.2 or similar), NIB... $385.00; 1/4 Rosenthal Ralley Morane (towplane), 2.78 meter span (109"), NIB... $295.00; 1/5 Wik Twin Astir, all glass, NIB... $595.00. Contact Robin Lehman, 63 E. 82nd St., New York, NY 10028, (212) 879-1634.

NEW PRODUCTS

The information in this column has been derived from manufacturers press releases or other material submitted by a manufacturer about their product. The appearance of any product in this column does not constitute an endorsement of the product by the R/C Soaring Digest.

1/2.7 PriBek ASK-18
...from Sailplanes Unlimited, Ltd.

The 1/2.7 PriBek ASK-18, 5.33 meter (209") span, wing profile E 203-201-193, weighs approximately 22 lb. It comes with a very light, high-gloss, epoxy glass fuselage with the wing rod tube installed, wheel with a shock-absorbing device built in, canopy, and canopy tray.

The wings are completely finished, spoilers are installed and capped, and the ailerons are completely finished. The rudder and stab are also completely finished. All flying surfaces are sanded and absolutely ready for covering. The wings come with a wing-retaining system completely installed on the root rib that mates with a device in the body, which keeps the wing on. This beautiful floater is responsive, yet docile, very stable, and it will thermal in the lightest of lift.

For more information, contact Sailplanes Unlimited, Ltd., 63 East 82nd Street, New York, NY 10028; (212) 879-1634, fax (212) 535-5295, or visit website: <www.sailplanes.com>. ■

MARKET PLACE LISTINGS

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finneys@mindspring.com
http://www.mindspring/~finneys

VACUUM FORMED PRODUCTS, CANOPIES
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The Harris Hill Soaring Corp.

Our event this year will again be at Harris Hill. There are some new developments to report. This year we will be given exclusive use of the Harris Hill Soaring Corporation's airfield on Thursday and Friday the 11-12. Thursday will be open flying (aerotow or slope) for early arrivals. Friday will be the start of the official event with radio impound. The field will be shared with full scale sailplanes, including ASK-21's, and Schweizer Trainers on Saturday and Sunday 13-14. Rides will be available during these days. Factory demos are scheduled for Saturday afternoon. National and international vendors will be showing their wares. The emphasis will be on fun and aerotowing, as well as some fantastic slope soaring, if conditions dictate. Tow planes and experienced pilots will be there to tow you to altitude. Bring your 3 meter (118") or larger aileron sailplane with nose release and join the growing aerotow movement. Scale gliders are recommended, but not required. We will have a few scale sailplanes available on site for those who can't bring their own. This year we are going to have pilots choice awards and a special award for the best Schweizer scale sailplane. Other prizes to be announced. On Friday evening there will be a picnic at the Harris Hill Youth Camp adjacent to the flying field. We will have an evening banquet Saturday night at the National Soaring Museum. Guest speakers to be announced.

More exciting plans are in the works, so keep an eye out for further developments as they become available. Current AMA membership is required. There will be a $25.00 pilot registration fee. For details & info. (including shipping your sailplane to Elmira), contact:

John Derstine
717-596-2392
johnders@postoffice.ptd.net
http://www.Geocities.com/CapeCanaveral/Lab/5739

R/C Soaring Resources

These contacts have volunteered to answer questions on soaring sites or contests in their area.

Contacts & Soaring Groups - U.S.A.

Alabama - North Alabama Silent Flyers, Ron Swinehart, 8733 Edgehill Dr. SE, Huntsville, AL 35802; (205) 883-7831, <ron.swinehart@svl.lmco.com>

Alabama - Central Alabama Soaring Society, Ron Richardson (Tres.), 141 Broadmoor Ln., Alabaster, AL 35007, <ron_mail@bellsouth.net>.

Alabama - Southern Alabama & NW Florida Aerotow, Asher Carmichael, (334) 626-9141, or Rusty Rood, (904) 432-3743.

Arizona - Central Arizona Soaring League, Iain Glithero, (602) 839-1733.

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"Summary of Low-Speed Airfoil Data - Volume 1" & "Volume 2", Michael Selig wind tunnel testing results. Cost for each: $25 USA (includes postage), $29 surface outside USA, $31 air Western Hemisphere, $38 air Europe, $42 air all other countries. Computer disk, ascii text files (no narrative or illustrations), is $15 in USA; $16 outside USA. Source for all "SoarTech" publications, also. Contact Herk Stokely, 1504 N. Horseshoe Cir., Virginia Beach, VA 23451. Phone (757) 428-8064, email: herkstok@aol.com.

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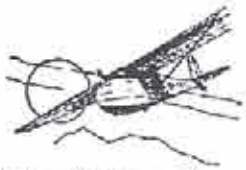

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