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# MODEL BUILDER

'ORLD'S MOST COMPLETE MODEL AIRCRAFT PUBLICATION

DECEMBER 1988

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volume 18, number 203

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## CONTENTS

### FEATURES



### THREE-VIEW



### CONSTRUCTION



COVER: Here's a sure-fire way to beat the cold weather blues: two lovely models from Hawaii, one female, one a Waco Taperwing. First things first; Miss Cori Ireijo, a student at the University of Hawaii certainly caught your eye, so 'nuff said. The Waco Taperwing, built from *Model Builder* plans that appeared in our November 1981 issue, is the work of Terry Nutt, Maui resident. The Quadra engine has since been replaced by a Sachs-Dolmar, which certainly improved the performance of this quarter-scale beauty. The Waco, built of alderwood and covered with MonoKote, is guided by a seven-channel Futaba FM radio system. Photo: Randy Hufford.



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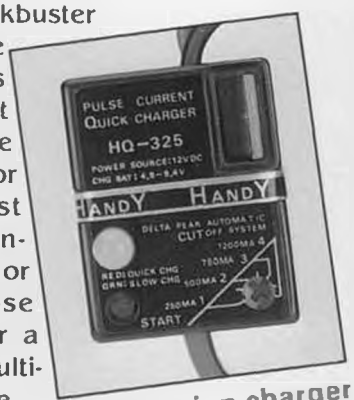


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*Large LCD indicator screen monitors all programming functions.*



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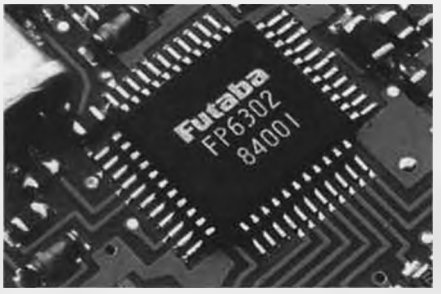


*An inside look at the R129DP shows the exclusive Futaba PCM 1024 microprocessor and surface mount construction (SMT).*

while the 7UAF is equipped with an R128DF/8 Channel, dual conversion FM unit.

The R129DP and R128DF are assembled using the latest, SMT construction for super reliability, efficiency and compact size.

## ERGONOMIC ENGINEERING

The stunning electronics of the Futaba Seven Series are encased in an all-new transmitter case, ergonomically designed for comfort and optimum control access.

The contoured back gives you a more stable grip. Mix, rate and auxiliary channel controls are slanted for easier reach. And the open gimbal control sticks are adjustable for length.

## CHOPPER COMPUTER

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Join the computer age. The new Seven Series from Futaba are the systems advanced airplane and helicopter pilots can count on.

*7UHP PCM 1024 Transmitter.*

**Futaba** 1 2 2 4

**Futaba Corporation of America**
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# Vanguard sets the pace.

Vanguard sets the pace all other FM and PCM systems must follow. Designed with advanced features and a stylish high tech appearance, Vanguard is the first R/C system to offer *true* 1991 performance and capabilities, at a down to earth price.

*Top quality Airtronics precision gimbals.*

The economical Vanguard FM and PCM systems incorporate the same quality craftsmanship and state-of-the-art component technology of Airtronics' most sophisticated R/C systems.

Vanguard comes complete with High Quality Rechargeable NiCd Batteries and Servo Reversing on All Channels. Precision gimbals give Vanguard the responsive feel and critical control of our most advanced aircraft systems. Fully adjustable length and tension sticks provide modelers with extremely accurate control response.

Dual Rate elevator and aileron controls, and electronic trims for maximum aircraft performance are additional standard features offered on the VG6DR FM and VG6P PCM systems.

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*Trainer system. Available on Vanguard FM only.*

Suitable for beginning and sport flyers, Vanguard is the first low-priced FM system to offer you total 1991 flight capability. Vanguard utilizes Airtronics' reliable Gold Label Super Narrow Band Dual Conversion Receiver for superior aircraft performance and control.

You get a clearer, more efficient signal that's less susceptible to specific types of interference, image frequency

and intermodulation problems. Vanguard gives you all the technological advantages of super narrow band FM operation at a price comparable to most AM systems.

Vanguard FM systems also incorporate a convenient Trainer system which allows any two Airtronics Trainer-equipped transmitters, coupled by a cable, to control the same airplane, for easier flight instruction.

## A Competitively-Priced PCM

Vanguard PCM systems feature advanced component design, a Gold Label Super Narrow Band Dual Conversion Receiver, and the same sophisticated Pulse Code Modulation technology available in our higher priced R/C systems.

Airtronics' sophisticated microprocessor-based Pulse Code Modulation technology offers modelers all the advantages of virtual trouble-free operation.

Vanguard PCM systems feature a Transmitter Low Voltage Audio Alarm and a Fail/Safe mechanism that automatically resets control position, enabling you to fly through unexpected interference. A convenient PCM/PPM Switch gives you the ability to switch between Airtronics PCM or FM receivers for greater system flexibility.


The VG6P PCM system also incorporates Adjustable Low Throttle and Elevator Flap Mixing functions for enhanced flight control.

These high quality Vanguard PCM transmitters offer you unmatched system features and unsurpassed performance at an affordable price.


*Vanguard PCM Receiver.*

## A True 1991 Receiver

All Vanguard FM and PCM systems feature Airtronics' Gold Label Super Narrow Band Dual Conversion Receiver. These state-of-the-art receivers give you all the advantages of superior image rejection, improved sensitivity, narrow bandwidth and maximum interference rejection.

Equipped with this compact, high performance Airtronics receiver, Vanguard is the first complete R/C system that meets or exceeds all the AMA specifications and guidelines for operation in 1991 and beyond.

## Airtronics' Commitment to Quality

Vanguard series radios are fully compatible with all Airtronics' quality accessories, servos and radio systems. Airtronics is the only major R/C manufacturer that offers you full product compatibility.

All our FM and PCM servos and accessories have the same interchangeable plug types used on our reliable AM systems. Airtronics' state-of-the-art transmitters meet all AMA and RCMA Gold Sticker requirements and specifications. Our FM and PCM R/C systems meet and exceed all 1991 AMA guidelines, assuring you fully functional operation in 1991 and beyond.

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Vanguard FM and PCM systems incorporate functional system design, high quality advanced technical features, and superior 1991 flight performance, at a competitive price.

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Airtronics' complete product catalog is available for $2.00. Please send check or money order to Airtronics, Inc.

At Airtronics, we want to be known as the best, not just the best known.


# from Bill Northrop's workbench

**Seven-year-old Justin Burnett waves from the cockpit of the 11-foot span "Link" trainer build by his grandfather, O.D. Burnett, retired Air Force Master Sergeant from Azle, Texas. The trainer will climb, dive, bank, and spin, all in response to control stick and pedal movement. Hmmm...with a big Sachs-Dolmar and reduction belt drive....**

• The 1989 IMS (International Modeler Show), scheduled for Saturday and Sunday, January 14 and 15, 1989, is beginning to come together. As this is being written (the first of October), 106 companies have already officially registered, with many more "getting around to it." A list of the registrants up to October 1, 1989, follows this discussion.

Note that we have changed the title to Model *Sport* and Hobby Show, as first used at the 1988 Atlanta premier. This is in recognition of the fact that our. . .er. . .hobby has really changed in recent years. More and more of those involved in the operation of model aircraft, cars, and boats are not modelers, at least not at the start. With the proliferation of ARO models (that's Almost Ready to Operate, a term that includes all three categories), there are many new enthusiasts who have become involved to enjoy the *sport* of operating models and who are not really interested in the hobby of designing and/or building their own models. While a few of these will stay with the sport and become model hobbyists, the others will "pass through" to other sporting activities. Anyway, the idea is that our show is designed to please "all of the above," and, maybe in the process of seeing the manufacturers of the products that are purchased "ready to use," the passing through enthusiast may decide to take off his or her coat and stay awhile.

Those who attended the 1988 show will recall that the entrance to the show was through the Conference Building, ground (or upper) level. This will be repeated in 1989, but with one major change. The entrance level, which contained model railroad and model ship club displays, will be used for the ever-popular Swap Shop. Downstairs in the Conference Building will again be the location of most of the model car and boat manufacturer exhibitors and will include the car track and boat pond for live demonstrations. Since the 1988 show, the former Swap Shop area, called the Annex, has been enlarged to almost double its previous size, and for 1989 will be used for the model railroad displays, competition static model displays, and as many as 50 manufacturer exhibitor booths.

Here is the list of exhibitors who have signed up as of October 1, 1988:

Academy of Model Aeronautics
Ace R/C, Inc.
Aerospace Composite Products
Air Age Publishing
Ambrosia Microcomputer Products
American Sailplane Design
Antique Radio Collection
APBA R/C Model Racing Commission
B & L Racing Products
Bell Rock Industries
Boca Bearing Co.
BoLink R/C Cars, Inc.
Bondhus Corporation
Bridi Aircraft Designs, Inc.
Buzz Waltz R/C Designs
Cannon R/C Systems
Charlie's R/C Goodies
Cheetah Models
Conley Precision Engines, Inc.
Custom Electronics
Dahm's Racing Bodies
Dave Brown Products
Davey Systems Corp.
DCU
Dumas Products, Inc.
E. H. Yost & Co.
Eldon J. Lind Co.
Fourmost Products
Futaba Corporation of America
GM Precision Products, Inc.
Golden Age Models
H & N Electronics
Hayes Products
Helicopter World, Inc.

**Combining the old and the new, Allan Wall, Kootingal, NSW, Australia, built this Lanzo Puss Moth, installed a geared Astro cobalt 035, driven by five or six Sanyo 900 cells, Jomar SC-5 throttle, and Sermos connectors. Weight is 2-1/4 lbs. and it takes off water in 30 feet turning a 10x5 prop. Flies in calm or rough, gusty weather, about 15 minutes per charge.**

Hobby Lobby International, Inc.
Hobby Merchandiser
Hobby Shack
Horizon Hobby Distributors
Hurricane Fans
Impact Engineering
IMS Headquarters
IMS Raffle
J & Z Products
J'Tec
J.C. Model Supply Co.
Jarel Aircraft Design & Engineering
Jed's Shade Canopies
Jomar Products
K-Bee's Modeling
Klotz Special Formula Products
Lanier R/C
Lazer Lite Racing
M.D.M. Co.
Mac's Products
Massey Aviation Products
Matrix Enterprises, Inc.
McDaniel R/C, Inc.
Model Builder Magazine
Model Marine Classics
Model Rectifier Corporation
Model Research Labs
Model Retailer Magazine
Novak Electronics
Paper Airplanes International
Paul's Flying Stuff
Peck-Polymers
Penn International Chemical
Performance Specialties
PK Products
Polk's Model Craft Hobbies
Powermaster
Pro-Cut Decals
Product Design, Inc.
Quickdraw
R/C Model Cars Magazine
Race Tech, Inc.
Racing Wings Co.
Radio Control Race Center
RC Video Magazine, Inc.
RJL Industries
Rotary Wing Connection
Royal Products Corporation
Safety "Plus'
Scale Model Research
Scale Plans & Photo Service
Scale R/C Modeler Magazine
Scande Research, Inc.
Schlueter Free Flight Models
Ship Modelers Association
Sig Manufacturing Co., Inc.
Sullivan Products
Sun Fair Aircraft Designs
Superior Aircraft Material
Sure Flite Enterprises, Inc.
Technopower II, Inc.
Tecnacraft
The Edjer
TMS Products
Top Flite Models, Inc.
Traxxas Corporation
U.S. Boat & Ship Modeler Magazine
Vinylwrite Custom Lettering
WCM Corporation
Windsor Prop/Master Airscrew
Winners Circle Resorts, Inc.
World Engines, Inc.
Yellow Aircraft & Hobby Supply

**F/F RECOVERY BY R/C**

In this year of national elections, with all its campaign speeches full of accusations and promises, the pro and con discussions about R/C recovery of free flight, whether in

*Continued on page 107*

**Avro Lancaster built by John Considine, of Bossley Park, NSW, Australia. Span is 88 inches, weight 8-1/2 pounds, powered by four O.S. 10 FSR engines, Rhomair retracts, and controlled by a 6-channel Futaba radio system.**


**ADVICE FOR THE PROPWORN**
**—By Jake**

*Dear Jake:*

*Thought I'd drop you a line and update you on our Loch Ness research. In my earlier letter I told you how we were using radio-controlled cameras to try and capture Nessie on film. Well, we have taken that idea one step further and we now have those radio-controlled cameras mounted on small radio-controlled submarines. This allows us to go out and search for the famous Plesiosaur, instead of just waiting in one place for her to swim by. Rather than randomly searching the whole lake, we wait until we have a sonar reading, then we send out our fleet of mini-submersibles to that location and photograph whatever we find.*

*I am pleased to report another breakthrough! As you can see from the enclosed photographs, we have not only captured the Loch Ness monster on film, but we have proven conclusively that there is more than one of the animals alive in the Loch. Photo #1 shows Nessie at rest at the bottom at a depth of 326 feet. We found this site from a very high magnitude metallic return on the sonar. (We have concluded that iron content in Nessie's diet has partially metallized her scales, and thereby accounts for the metallic nature of the sonar image.) Note the cigar-like hump of the body and the tail fins at the rear. One hump clearly visible at the top center of the body. This hump is approximately the shape of a conning tower. Note also the distinguishing white markings on the side of the otherwise black body. These naturally occurring patterns look remarkably like the letter U and the numbers 7 and 3.*

*The proof of a second animal is evident in the second photograph, taken at a depth of 112 feet at a site 7 kilometers distant from the first. It shows a similar animal, complete with tail fins and a conning-tower-like*

*Continued on page 106*

# OVER THE COUNTER

*All material published in "Over the Counter" is quoted or paraphrased from press releases, furnished by the manufacturers and/or their advertising agencies, unless otherwise specified. The review and/or description of any product by MB does not constitute an endorsement of that product, nor any assurance as to its safety or performance by MB.*

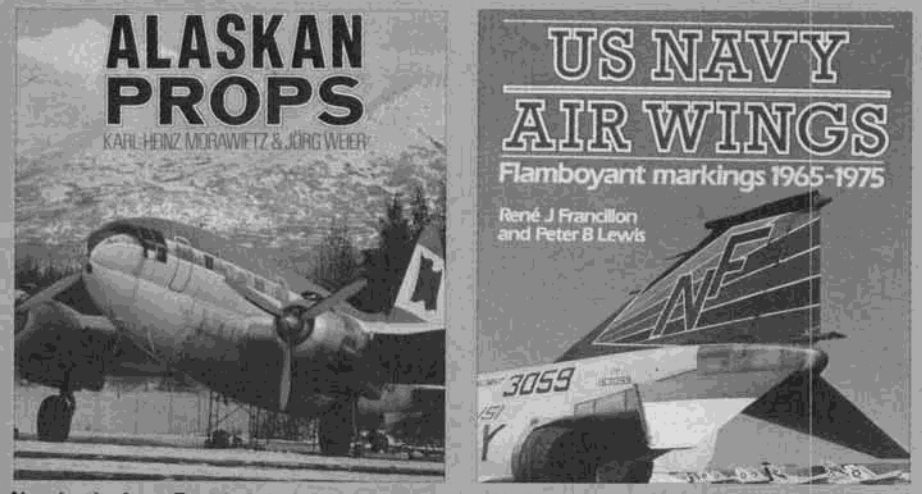
• With the holidays upon us, it is a good time to take a look at some new products that would make dandy gifts for yourself or a modeler you may know. The clever dropping of hints to loved ones is encouraged here; leave the magazine open to the Over The Counter section with your choices subtly circled with a bright red marker and the notation "Please!" in the margin. That should get the idea across to your better half, or whomever you're targeting with the sneaky suggestion that you just don't see how you could make it through another Christmas without a new servo, or model, or *something*.

If you are looking for some aviation-related books, look no further. How about *Alaskan Props*, a full-color, 128-page paperbound book devoted to the rugged planes supplying the Alaskan wilderness. If that's too chilly for you, Zenith Aviation offers a terrific new volume, *Aircraft Archives, Volume One, Fighters of the World Two*; and *Postwar Jets, Volume One*. These 8-1/2 x 12 books are full of scale drawings and black and white photos showing exquisite detail of a Gloster Gladiator, Spitfire, Boulton Paul Defiant, DeHavilland Mosquito, Dornier Do 335, and more. The postwar jets included in that volume are afforded the same lavish detail as the WWII planes. These include the Starfire, Mirage IIIC, Grumman Tomcat, BAC Lightning, F-100 Super Sabre, F-84F Thunderstreak, and many more. Once you see these books, you'll know why you just have to have a set for your own library.

Also from Zenith this month is another full-color, 128-page book in the Osprey series, the *US Navy Air Wings*, which shows in brilliant color Skyhawks, Crusaders, Vigilantes, Phantoms, and Skyknights in flamboyant markings that highlighted the decade of 1965 to 1975. All of these books, as well as a catalog filled with many more, are available from Zenith Aviation Books, Box 1, Osceola, Wisconsin 54020.

* * *

Great Planes Model Distributors and Kyosho Models have just announced the newest in their fleet of 1/19-scale electric R/C models, the Cessna Cardinal. This 47-inch span model is a stable flyer and capable of being an ideal electric trainer. The ARF model features a one-piece fuselage and balsa wings and tail, which come precovered. Also included are a LeMans 05R motor, control rods, prop, spinner, decals, and adhesive. Look for the Cardinal at your Kyosho dealer.



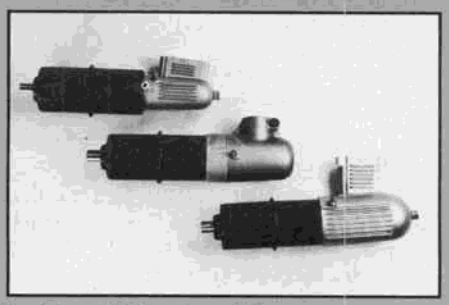

New books from Zenith Aviation include these on Alaskan flying and flashy Navy jets.


1988-89 book catalog from Zenith Aviation.


Aircraft Archive looks at WWII fighters.

* * *

Another good-looking ARF model is the new Hirobo/Futaba Chipmunk. The fuselage and wings are finished and covered, and all necessary linkages and hardware are in the box. The pushrods and motor mount are factory-installed. Powering the electric Chipmunk is a rewound 540/5 motor, with a 9-inch nylon prop. Wingspan is 47-1/2 inches, and weight is about 2-1/2 pounds. A three- or four-channel radio with a speed control is needed to fly this bird. For more information contact Futaba at 555 W. Victoria St., Compton, California 90220.



Snuf-Ler Mufflers from J'Tec.

Great Planes/Kyosho Electric Cardinal ARF model.


Futaba's aerobatic Electric ARF Chipmunk.


Precision-built 1.2 model engine by Conley.

* * *

For the free flighters among us, Campbell's Custom Kits Busy Bee, an .020-powered, all-sheet balsa model is just the thing for the Pee Wee 30 event that has become so popular. The Busy Bee was designed by Bill Booth Jr. to be built in two evenings, with all parts precut and ready to assemble. This model is easy to fly, making it ideal as an introduction to free flight gas. Kits are now at your dealer, but if you can't find one, send $15.98 plus $2.50 for shipping to Campbell's Custom Kits, Box 5996, Lake Worth, Florida 33466-5996.

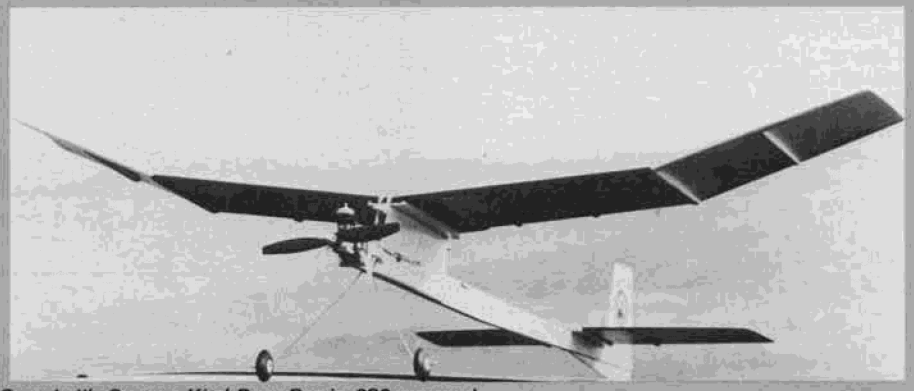
* * *

From Q-scale V-8 engine builder Gary Conley comes a precision 1.2 model engine for airplanes with belt-driven dual overhead cams, paired hardened and ground steel intake and exhaust valves inside a hard chrome cylinder. Conley Precision Engines are made in the USA using standard SAE threads. They are available factory-direct or through select dealers nationwide. Contact Conley Precision Engines, 820 Ridge Ave., Suite G, Lombard, Illinois 60148. Phone: (312) 953-8882.

* * *

Here it is almost 1989 already, and have we got a calendar for you! This DC Aviation calendar features 12 full-color radio control scale aircraft, photographed so well that it is hard to tell if they are full-size or scale models! For more information, contact DC Aviation, Box 98, Big Rock, Illinois 60511.

* * *



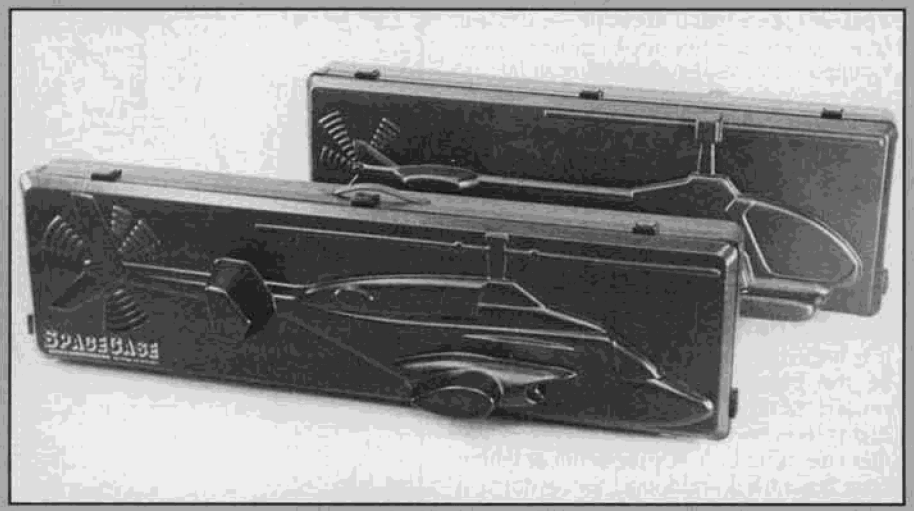
Campbell's Custom Kits' Busy Bee is .020 powered.

Helicopter pilots can get the new SpaceCase Helicopter case at a reduced price! The case is now molded from heat reflective grey ABS plastic, and the inside is ready to be customized to suit your own model. Craft from manufacturers such as Robbe, Kalt, GMP, and other .50- to .60-size choppers will be comfortably accommodated inside this protective and handsome case. For more information, contact Matrix, Inc., 7015 Carroll Rd., San Diego, California 92121. Tell 'em *Model Builder* sent you.

* * *

*Continued on page 102*


DC Aviation 1989 Calendar.




SpaceCase Molded Helicopter carrying cases.

# Building the R/C Guff

**If you've been following our series on the history of Walt Good's landmark R/C model, then you are primed and ready for the complete construction article presented here. Full-size plans are available, see page 106.**

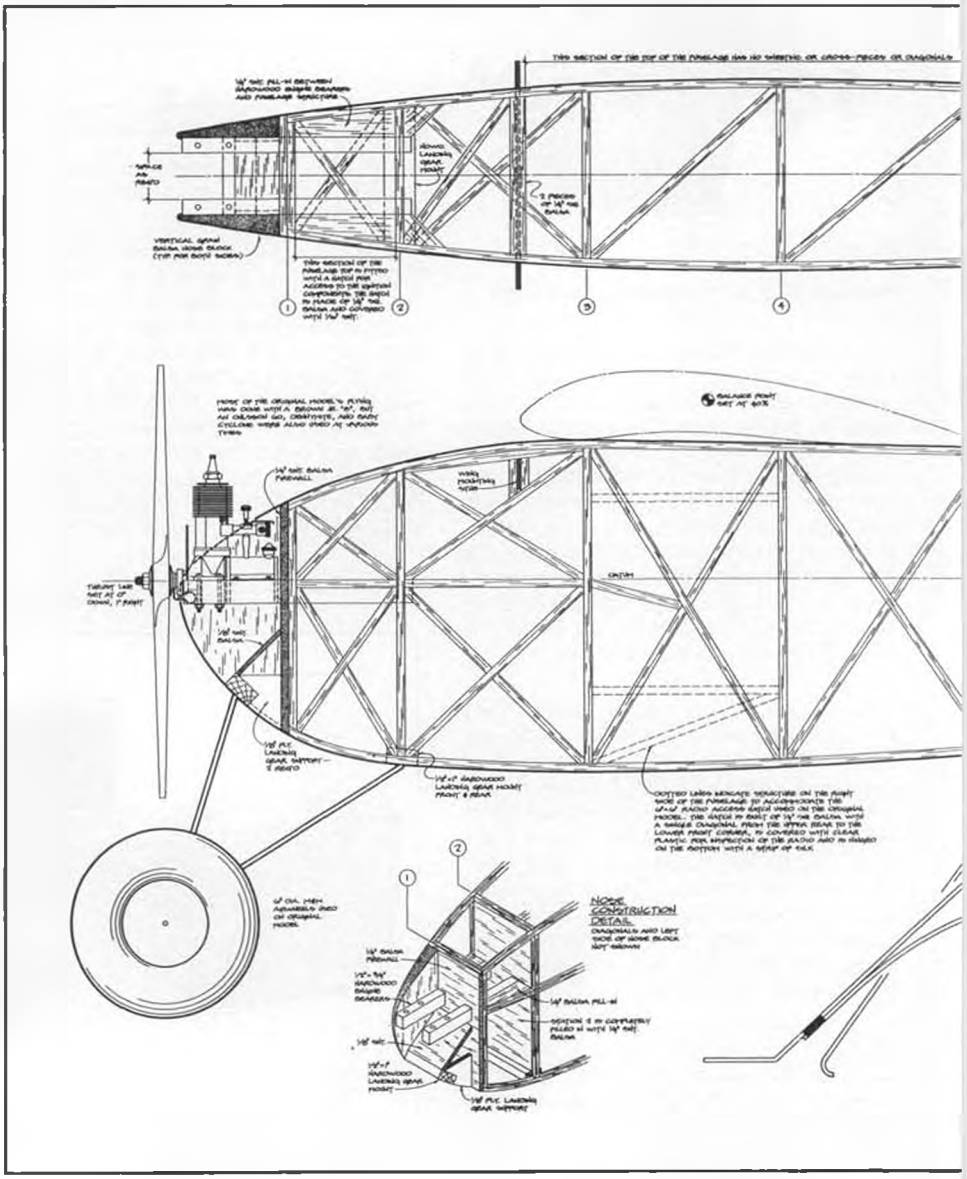
• *As I promised in the August '88 issue when introducing this series on Walt and Bill Good's history-making model, the R/C Guff, we are concluding with this presentation of the construction article for the plane itself. The plans have been drawn by Phil Bernhardt directly from the original presentation in the November 1940 issue of a three-part series in* Air Trails *magazine. Although some sketches and details of items, such as battery boxes, radio installation, ignition wiring, etc., have been deleted, the structural design has been totally unaltered. In fact, numerous telephone calls were made to Walt as the drawings progressed, making sure that all structure was correct and that no mistakes in the original presentation were being carried through to this new set of drawings.*

*Note that several photos revealed that Walt, the builder, had laboriously cut lightening holes in the wing ribs, though this is not indicated on the drawings. Why? Because Walt saved all of the cutout disks and found that the whole batch only weighed half an ounce, hardly worth all the effort to reduce weight!*

*Speaking of ribs, the original wing was built with three-piece ribs, as the spars were full depth. Unless you're a real masochist, there no need to go through this exercise, as Phil has shown an alternate wing construction following the modern I-beam method, using top and bottom "cap" spars with vertical-grain webbing.*

*Most modelers only read the instructions as a last resort, when all else fails; but we felt that, for old time's sake, we would reproduce the majority of the original introduction and building instructions. Except for modern adhesives and hardware, it's really not all that different. If you notice any discrepancies in wood sizes, etc., stick with the plans. And remember, the original aircraft weighed only a little over eight pounds, complete with radio, and still managed to fly with a Brown Jr. ignition engine, a power source that is about the equivalent of a modern .29 two-stroke glow engine. Granted, it usually needed manual assistance during takeoff, so you may want to use a .40 two-stroke or a slightly larger four-stroke, but keep it at that. This was a slow and majestic aircraft that made history. It's not Rodney Dangerfield; treat it with respect!*

**With John Gunsaullus launching, Walt Good begins takeoff of Rich Bonnell's Enya .46 four-stroke-powered Guff replica.**




Radio control of a model plane is a new and fascinating hobby. Every modeler dreams of controlling his own models, and it is hoped his enthusiasm will be livened by the presentation of this thoroughly proven radio-guided model. Over 150 flights have been executed with the equipment described, so only those things which have been tried and found successful will be included. In many of these flights, the plane was returned to within a few feet of

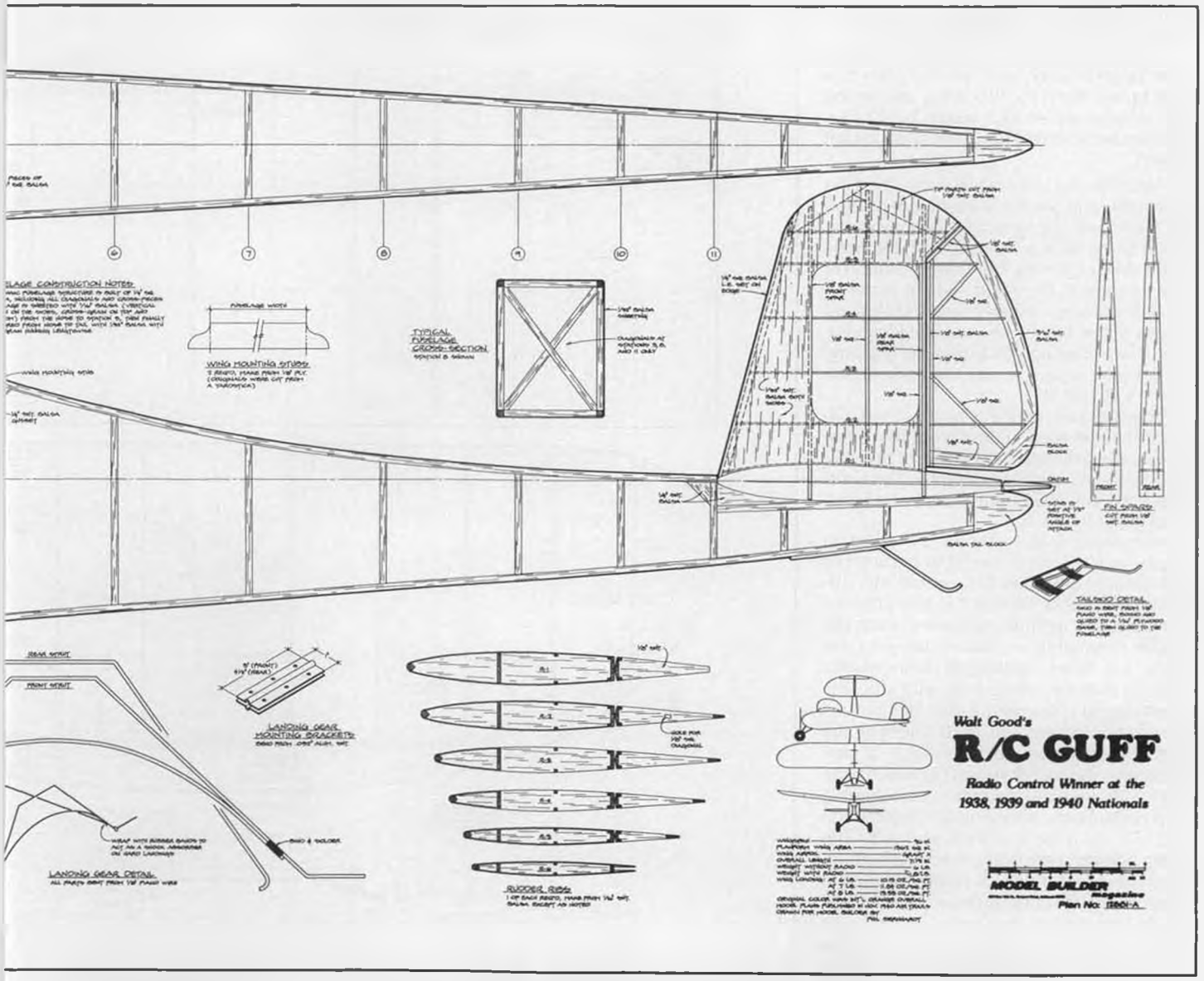
the takeoff; that's a real thrill, especially when *you* are doing the controlling.

The present ship carries two controls, rudder and elevator. It is suggested, however, that a rudder control alone is an adequate beginning. Complications arising from two controls are apt to be discouraging. Interestingly enough, the 1939 Nationals were won using only the rudder control. Simplicity is the keynote throughout the entire construction. Most modelers yearn for the super complete complex radio job. Try a simple one first.

Several years of experimentation have shown that the ship itself is as important as the radio unit it carries. Naturally, the weight must be carried easily. The glide and power flight speeds should be nearly equal to give the same response to control under both conditions. Side area considerations result in good turns to right and left. And finally, properly sized control areas are indeed essential.

In spite of its largeness, this ship is powered with a 1/5 hp Brown motor. It may be noted the ship has the same characteristic fuselage shape as the author's Guff. This seems to aid the spiral stability.

**On a low, slow, fly-by approach prior to setting up a landing pattern. Note wheels are in the old prop-saver position.**






FULL–SIZE PLAN AVAILABLE–SEE PAGE 106

**Walt enjoyed flying the Guff in its normal, old, slow style.**

## FUSELAGE

The body is of the strong semibox construction, covered with sheet balsa.

Find a large space (the body is over 5-1/2 feet long!) to work, and tack the plans to a soft board. Build the two sides, one on top of the other, of 1/4-inch square hard balsa. Remember, the right side has a door; the left hasn't.

Assemble the sides in two steps. Invert the two sides and pin the wing-mount portion to the board, gluing in all cross braces forward of the back wing stub. With the body right side up, pin the rear bottom portion of the fuselage to the board and put in the remaining braces. Several coats of glue on all joints is now (rather now than later) advisable. Place diagonals (not shown in drawing) of 1/4-inch square across the body at Stations 5, 8, and 11.

The stabilizer cradle is made of soft 1/4-inch sheet shaped to the rib outline. Since the cradle determines the angle of the stab, follow the dimensions carefully. The tip of the body is carved from a soft balsa block and glued in place.

Hardwood motor mounts are glued in place with the aid of the fill-in blocks. The whole front of Station 1 is covered with 1/4-inch sheet balsa. Station 2 is also filled in, isolating the ignition equipment from the radio compartment. After putting in the bass (or other hardwood) landing-gear blocks, coat the whole nose with glue. Repeat several times until a glasslike finish is had. This prevents oil from undermining the nose structure. Also use plenty of glue wherever the motor mounts come in contact with the balsa structure. After sanding the entire body, removing all projects, the body is ready for its sheet-balsa skin. The front portion of the body, sides and bottom, from nose to Station 5, is covered with 1/16-inch sheet with the grain running across the body. To put on these pieces, coat well with glue all members under the sheet. Just before shaping the sheet in place, run a ribbon of glue along its edge to fuse it to the sheet beside it. As much as a four-inch wide slab can be put on at one time. Again sand and now cover the whole body (even over the 1/16-inch sheet) with 1/32-inch sheet with the grain running the length of the fuselage. Use as wide sheets as obtainable and cover about two sections at a time. A paint brush instead of a glue stick will help here. Sand the balsa sheet carefully and give two coats of clear dope, sanding lightly after each. One or two coats of your favorite colored dope finishes the fuselage. The original ship is deep orange trimmed with Curtiss blue.

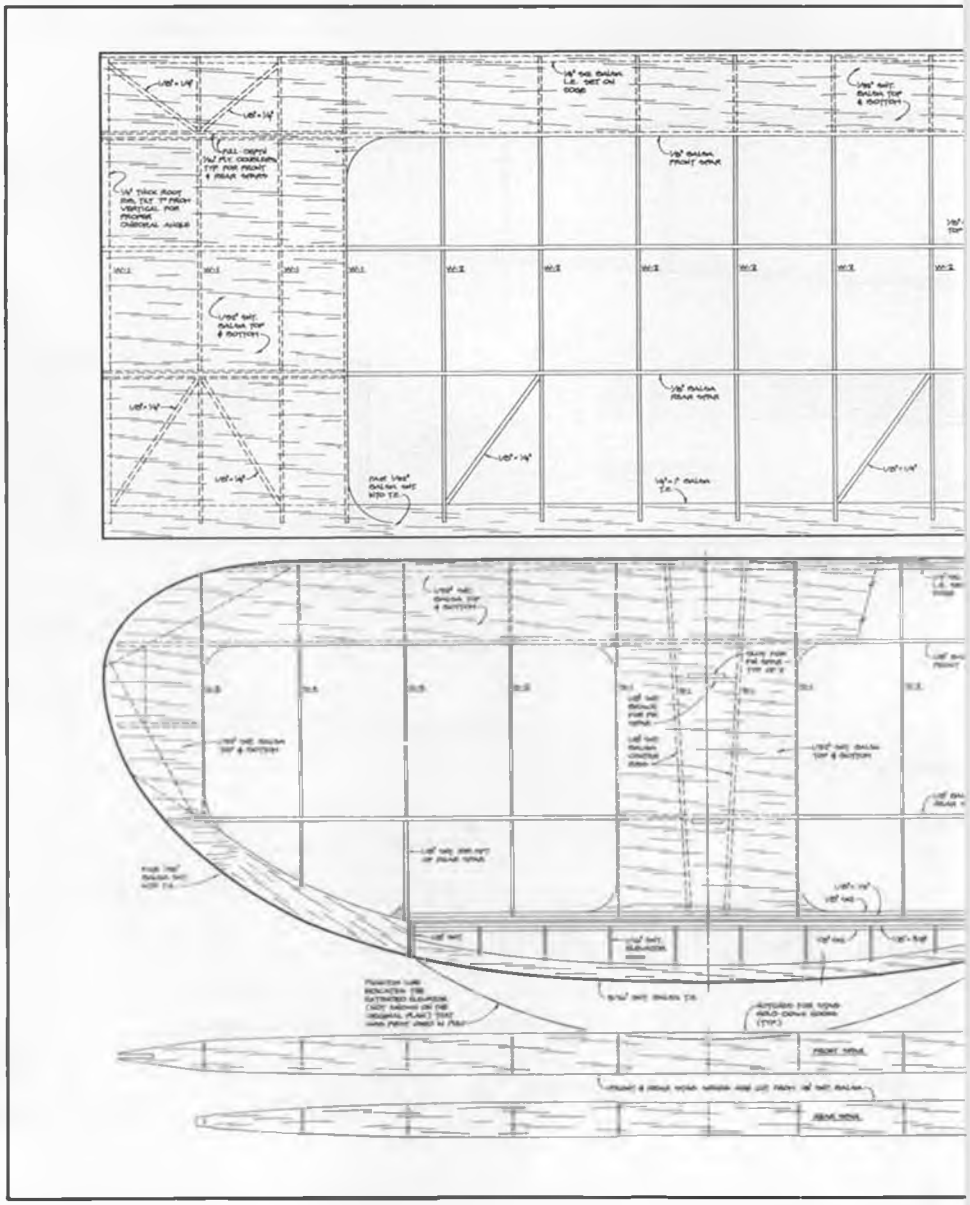
The hatch of the ignition compartment is made of 1/4-inch square framework and is covered with 1/16-inch sheet. Two pins hold it in place.

The transparent inspection panel, of 1/4-inch stock, is covered with cellophane. A silk hinge connects the door to the body.

## TAIL SURFACES

The rudder and elevator are constructed separately and joined together when finished.

The movable rudder flap is built apart from the stationary fin. Spars of the fin are of



hard 1/8-inch sheet. The rear spar has two strips of 1/8-inch square glued to its front side for strengthening.

Fin Ribs 1, 1A, and 5 are of 1/8-inch sheet, while the rest are of 1/16-inch material. Cement the ribs to the spars. Fit Rib 1 as closely as possible to the curve of the elevator airfoil, filling in the gaps with 1/4-inch soft sheet.

The 1/4-inch square leading edge is not rounded until after the sheet covering is applied.

The trailing edge of the rudder and the tip of the fin are 1/8-inch sheet. Notch the fin spars to receiver the tip.

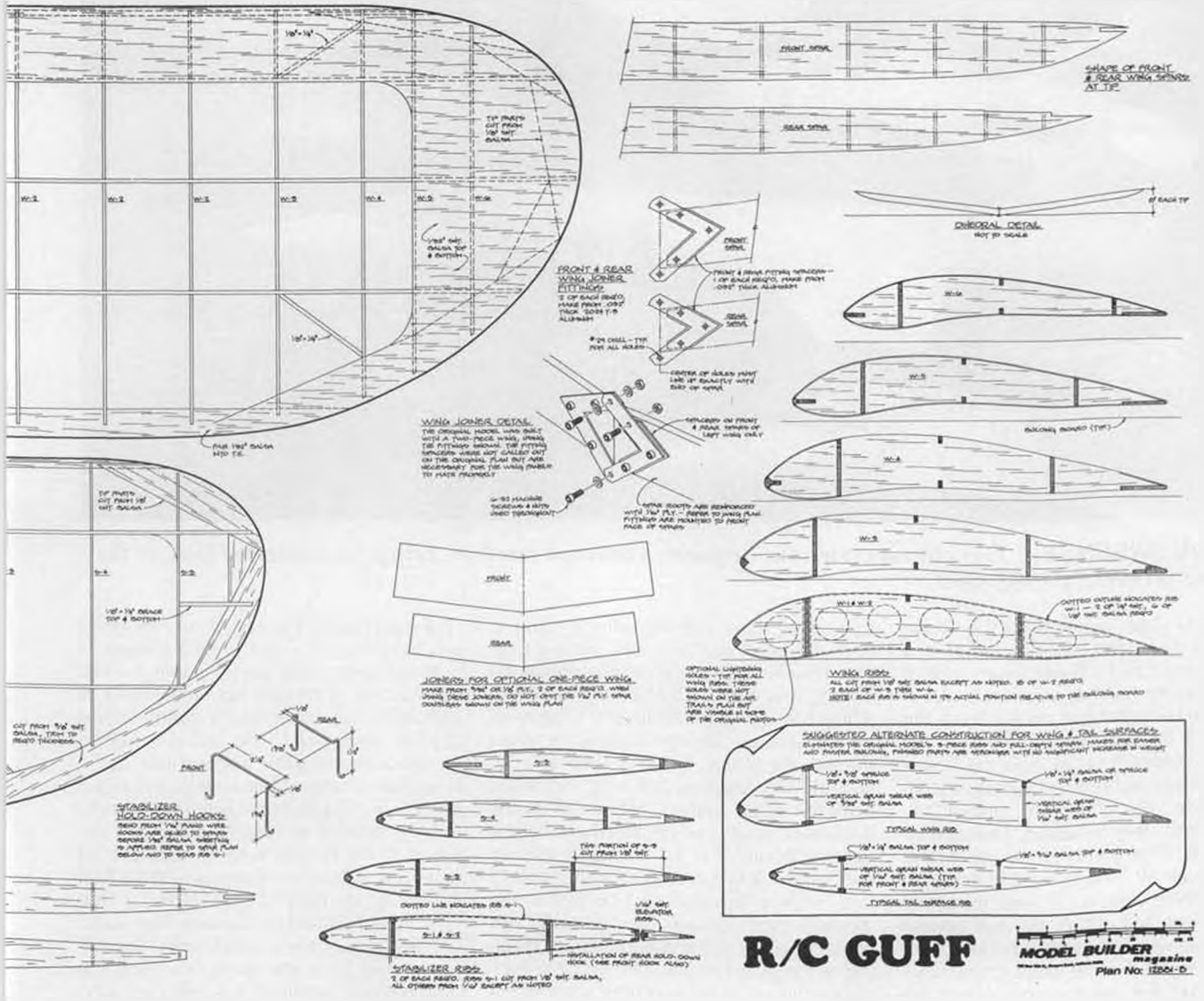
Cover the indicated portions with 1/32-inch sheet balsa, running the grain parallel to the spars.

Keep the rudder flap light for easy flapping. Its spar has the back face reinforced with two strips of 1/8-inch square. Notch the trailing edge to take ribs.

Heavy-duty common pins are glued firmly to the upper and lower ends of the rudder spar, and project 1/8-inch. These are the pivot pins and they turn in holes in thin

*Continued on page 100*

**At R/C World in Orlando, Florida, the fliers get together with the Guff replica for a family-style photo: Walt Good, John Gunsaullus, and Rich Bonnell, builder of the replica model.**



# The Abingdon Fan Fly


**By RON SWEENEY. . .Our correspondent in England, a devoted fan flier, brings us a colorful look at the premier jet event's 1988 meet.**

• Last year's video recording of the '87 fan meeting at Abingdon was concluded by a short commentary by David James, one of England's more notable exponents of our craft, when he stated that the event was the oldest and the best fan meeting in the world. The oldest it certainly is; the best is obviously only an opinion, but one shared by all those who attend this annual pilgrimage into the beautiful Oxfordshire countryside. The numbers are still rising, and although 59 models were checked in for flight, there were quite a few more that were present but didn't fly and several "characters" who flew and didn't check in.

Having enjoyed a fine warm spring I was praying that the weather preceding the event would hold out till the Sunday, but the signs were there that we weren't going to have things all our own way. Having forecast a fine warm day, the weathermen got it wrong, and the 3-1/2 hour trip down to Abingdon saw the windshield wipers on my car working overtime to allow me to see through the gloom. My ever-optimistic 12-year-old son Andrew, clutching our newly acquired video camera, patted me on the back reassuringly and promised me that the weather would clear. Arriving at the gates of the massive RAF base of Abingdon at 9:15 a.m. with no prospect of a change in the weather didn't in any way dampen our spirits, and the cheerful and tolerant greeting of the guard on the gate brought back old memories of my own time spent in the Queens Air Force as an aircraft engineer. (The boys haven't lost any of their charm.) I pity the girls in the surrounding villages.

As we approached the flight line, my first site was not of models but large sheets of flapping polythene and huge candy-striped golfing umbrellas. The usual renewed greetings were slightly disconsolate, and a brief glance around the airfield revealed a misty half-mile horizon. Foreign car registrations were in evidence—a Belgian (my friend Philip Avonds is here, yes that's his new F-15). A French registration—that's Paul Ratajczak, secretary of the MACH 2.2 club (The French D.F. organization). This looks like the makings of a good event. The following half hour was spent unloading the "cargo." The important bits first, my son's lunch pack, no mean task considering its

Formerly Philip Avonds' Mirage, the model is now owned by Mr. Dwek from Belgium. Powered by a Rossi 90, it's fast and superbly prepared.

John Richard's scratchbuilt Gripen, powered by an OPS/Thorjet, went unflown due to radio problems this day.

contents, followed by my models and accessories.

My customary and habitual practice on such occasions is to stroll around the assembly looking at the latest offerings. This was most difficult since most were sheltering from the persistent rain under their makeshift plastic canopies. Unperturbed by the weather, the numbers swelled continuously until it was evident that the preordained model compound was too small to contain the numbers and a second location was occupied.

The rain, being gentle and subtle, had fooled me, and I hadn't realized that the huge umbrella I was carrying was no longer necessary. An awe-inspiring array of models, growing as the morning progressed, now bore witness to the subtlety of the change in weather. Activity changed from gossiping to modeling, and the normal cacophony associated with fan engine testing gradually commanded attention.

It is now reasonably forgivable to expect new projects to be present on such occasions, and I doubt anyone would have been disappointed. The array was dazzling, making my own meagre efforts pale into insignificance compared with some of the mouthwatering offerings on show.

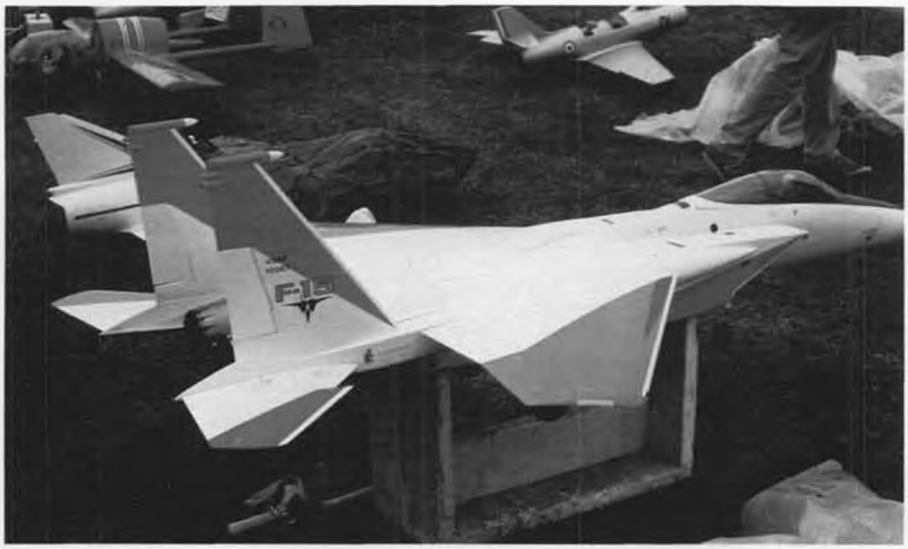
Without going into too much detail, there was evidence of increasing influence from the USA. Barry Conway impressed us all last year with his Viojet system installed in his F104. He repeated the exercise again this year with his predictable and immaculate performance not only on the ground, but also in the air. His Starfighter seemed even faster than last year. Pete Nye appears to have adopted the Dynamax fan as his favored unit. He powered his F-8 Crusader last year with Tom Cooke's excellent fan unit turned by an O.S. 77. This year he and his pals brought along two superb Panthers, which he has designed over the winter months. They flew as well as they looked and were a credit to his talent and skills, making use of carbon fiber in the construction.

So much is expected of Philip Avonds following his magnificent performance last year that he isn't allowed any room for error. This year he produced an immaculate version of his F-15 kit, and although plagued with engine difficulties he proceeded to thrill the crowd and fellow pilots with a


Panthers are Peter Nyes' latest creations, with O.S. 77/Dynamax systems for power. Fuselages are glass and foam, with carbon fiber-reinforced wings.


Tiger Sharks from Thorpe plans, powered by K&B, Picco, O.S., and OPS; all use Thorjet fans.


Paul Thorpe prepares for flights with his F-104 and F-20, both very fast. The F-104 was written off after radio interference.



Named Best Finished Model at the show, Philip Avonds' F-15 is his own version of his kit, with two K&B 7.5 engines and Turbax fans. It had engine problems, but still ran well.

stunning performance, sometimes operating on only one of his two K&B 7.5s.

The K&B is still very much in evidence, and my own Thorpe Brothers Tigershark completed several very fast flights with my K&B turning my Thorjet unit in excess of 23,700 rpm. Of equal merit was the performance of the Picco 45. One particular engine powering another F-20 was piloted by Jim Fox with fine skills and flew at great speed with prolonged high speed passes both upright and inverted in a flawless manner. There were no less than five examples of this model present. All current 45 engines were in evidence in these models, and there was little to choose between them in the performance stakes, despite some of these engines retailing at twice the price of their contemporaries.

A huge A-10 Thunderbolt brought by John Menhennet was also very professionally flown. Being accustomed to the slightly off peak resonance of the twins, I twice mistook the purity of the engine note to be that of a single engine. I'm sure most of you will recognize the fateful sound of a single engine on a twin. Tuning was so good that the engine synchronization was perfect and sounded as one; the two Picco 45s repaying John's preparation with complete reliability throughout the day.

I am sure that particular designs attain popularity and appear in numbers during particular flying seasons, and I have witnessed the rise and fall in popularity of several models. This year was the turn of the Thorpe F-20 and the Peter Nye Albatross, both proving their soundness and reliability in past seasons. The perennial Hawk was once again flown by several pilots and remains an all-time favorite, with all three versions being demonstrated. The very impressive F-15 Eagle was modeled in three guises. Dave Nieman, a model shop owner brought along two Byron kit versions which he and his colleagues flew with great skill. Philip Avonds, although plagued with engine troubles, proved the soundness of his design by some excellent single-engine performances. My favorite on this occasion however, was Alex Cornish-Trestrail's scratchbuilt design. Powered by two superbly prepared O.S. 25/Kress 7290 fans, the model made countless flights and was rarely on the ground. At one stage late in the day I quizzed Paul Leighton, Alex's pilot, about battery life, and he reassured me all was well. I personally feel that two engines are four times the trouble, but I cannot recall a single occasion when Alex encountered the slightest problem, and he must be congratulated on his skills. Equally effective was his A-10 Thunderbolt also scratchbuilt in this instance powered by two Cox TD .051 engines and axiflow fans. This model was extremely light being hand-launched for takeoff. My attraction to these diminutive models lies in their ability to fly in small areas of sky both within sight range and ear shot. Paul threw both models around the sky, making it difficult to track them on camera. Despite these extreme aerobatic maneuvers, neither model appeared to lose speed. A nice feature on the Eagle was the

The author's own X-29 in foreground, not yet completed. Some of the competitor's planes are seen in the background.

John Menhennet's huge A-10 Warthog, scratchbuilt by John, is an excellent flyer. Power is two Picco 45s, and Thorjet fans.

use of a steerable dolly undercarriage. A servo had been installed in the dolly which merely disconnected when the model rose off the ground.

My friends the Thorpe brothers had, for them, an indifferent day, although others would have been satisfied. Having suffered the indignity of a traffic shunt (a fender bender) on the way down to Abingdon, Peter then suffered the misfortune of either interference or radio failure shortly after takeoff. His Starfighter suffered considerable damage resulting from the crash. Brother Paul, however, kept the flag flying with some impressive (as expected of the Thorpes) flying with his now ageing F-20, which flew as well as any of the newer versions, including my own.

A model I had looked forward to seeing was unfortunately grounded through radio problems. John Richards SAAB Gripen was wisely not flown. John had tested this excellent model previously and has sustained damage through aerodynamic difficulties. John had burnt the midnight oil to restore the model for Abingdon and suffered the disappointment but also the good fortune of identifying the problem as a radio fault on the ground rather than in the air. John has organized a fan meeting in early August near Ipswich and hopefully the flight performance of this excellent model will attest to John's design and building skills.

I mentioned earlier the problem with the weather. My son's optimism was partially justified when by late morning the rain abated. Although only brief glimpses of blue skies were seen, the weather remained calm but dull. There was little or no wind till late afternoon. A bonus I particularly enjoyed from the comparative still air conditions was the incredibly realistic and exceptionally long takeoff runs of some of the heavier loaded models. The comparatively late start to the day's proceedings meant that although there was an extended period of gossiping during the morning, flying activity intensified immediately before and after the lunch break. At times the air was full of models with sounds reminiscent of locust swarms; music to my ears.

Gerry Jackman, absent for several years, reappeared with his scratchbuilt Bar Jay twin boom model powered by his own gas turbine. Most of us had thought that Gerry and his team had abandoned the project but were delighted to learn that his miniature masterpiece has undergone continuous development since its last appearance. Although the model didn't fly, he test-ran the engine twice during the day. The sound of this power unit has to be heard to be believed. I've recorded it on tape and my pals in the US will have a copy later this year. Gerry brought along the moldings of his next project. Gerry plans to install his engine in a scratchbuilt Folland Gnat, which is an advance stage of development. The engine produces nine pounds of thrust. Though currently running on propane gas, Gerry's team are hoping to convert the fuel system to butane for simplicity of fuel

*Continued on page 84*

John Wright's own design Edgley, with an O.S. 60 and an Optica ducted fan.

Phil Endean's semi-scale E.A.F., a very sprightly flyer with an O.S. 25 VRDF.

Jim Harrison's plan-built Star Cobra. A different and pleasing approach to fan flying. OPS 45/Thorjet powers the model.

Reg Smith's Foxbat with two O.S. 46s and Thorjet fans, and an F-16 prop kit conversion; all are excellent flyers.

# CHOPPER CHATTER

**BY DICK GROSSMAN**

• A question I am asked frequently is: "What's the best helicopter for a beginner?" To that question I usually respond with a few of my own: Is the "beginner" a mechanical engineer or a shoe salesman? Is he an 18-year-old video game whiz or a middle-aged couch potato with ten thumbs and two left feet? Sometimes people get a little annoyed with me for giving them the third degree when all they did is ask a simple question.

Anyway, I've just built and flown a chopper that I think *is* the best helicopter for *any* beginner; it's the Kalt Cyclone distributed through Hobby Dynamics of Champaign, Illinois. Think of all the attributes you'd look for in a first machine; you'll find the Cyclone has nearly all of them. For example:

1. Low price. How about $299.99 *list* price! That's $100 to $200 less than anything else out there.

2. Ease of assembly. Preassembled rotor head, mixer, and swashplate; molded frame and servo trays; finished and balanced main and tail rotor blades. The ads say "four- to six-hour building time." I'm afraid that's an exaggeration. Double that and you'll be a lot closer to reality, but that's still pretty good. The instructions are adequate, but they could be a lot better. The "exploded view" illustrations used are excellent, but the narrative is very terse, almost abrupt, and doesn't explain many of the finer points of construction, setup, and flying.

3. Easy to fly. This is a big helicopter, designed for a 50 or 60 engine. There's no question that it's better to learn on a larger machine with plenty of power, particularly when using training gear. They hover better, are smoother in forward flight, and get out of trouble easier than smaller helicopters.

4. Sturdy. The thick, molded plastic composite sideframes, aluminum tailboom, flexible landing gear struts, and all-metal rotor head make this one tough machine.


**Author locks in on shoulder-high hover.**

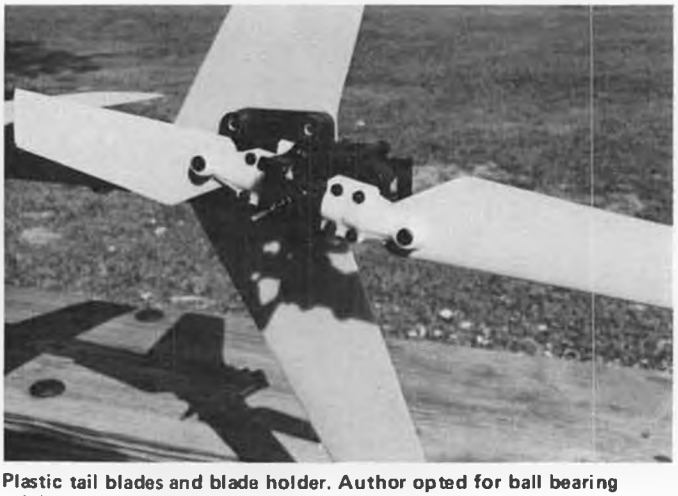
How tough? Dan Melnik of Florida, a top competition pilot, lost his temper and started *jumping* up and down on his Cyclone. He was unable to break the sideframes and servo trays!

5. Parts availability. A problem in the past that nearly destroyed the popularity of Kalt helicopters in the U.S. The new Hobby Dynamics has promised they won't let us down.

6. Versatility. Upgrades are available which include a 60 engine motor mount, toothed belt tail rotor drive, tail boom support, autorotation clutch, and any number of rotor heads and mixers. Collective pitch travel is plenty for aerobatics and inverted flight, so you can start with a trainer and nickel and dime yourself up to an excellent aerobatic machine when you're ready. Also, there are scale fuselages available that will adapt well to the Cyclone mechanics.

The big argument I'm expecting is that the ready-built helicopters out there make it easier for a beginner to get started. I don't buy that! Helicopters have a life cycle, sort of like flowers and trees. They're built, flown, crashed, rebuilt, flown, crashed, rebuilt, flown, crashed. Whether your helicopter is in the box or has been completely assembled, it's still just a phase of that "cycle." Either way, you're going to have to rebuild it one day, and that fact makes the Cyclone more of an ARF than many that are advertised as such. It's easy to build the first time, and it'll be easy to build the second time. The components are strong, particularly the mainframes and servo tray assembly, and it will hold together well through


**Rear gyro installation and Tech Specialties "bendable" antenna.**



**Plastic tail blades and blade holder. Author opted for ball bearing ptich control plate.**

the bumps and bruises that are inevitable when first learning to hover.

It takes a 50- or 60-size engine which costs more and uses more fuel than the smaller engines, so you might think this would make it more costly to own and operate. It doesn't quite work that way. Those 28 engines don't last as long under the stress of chopper use as well as the larger engines, and the extra power that you get from a 50 or 60 can prevent a lot of crashes, too.

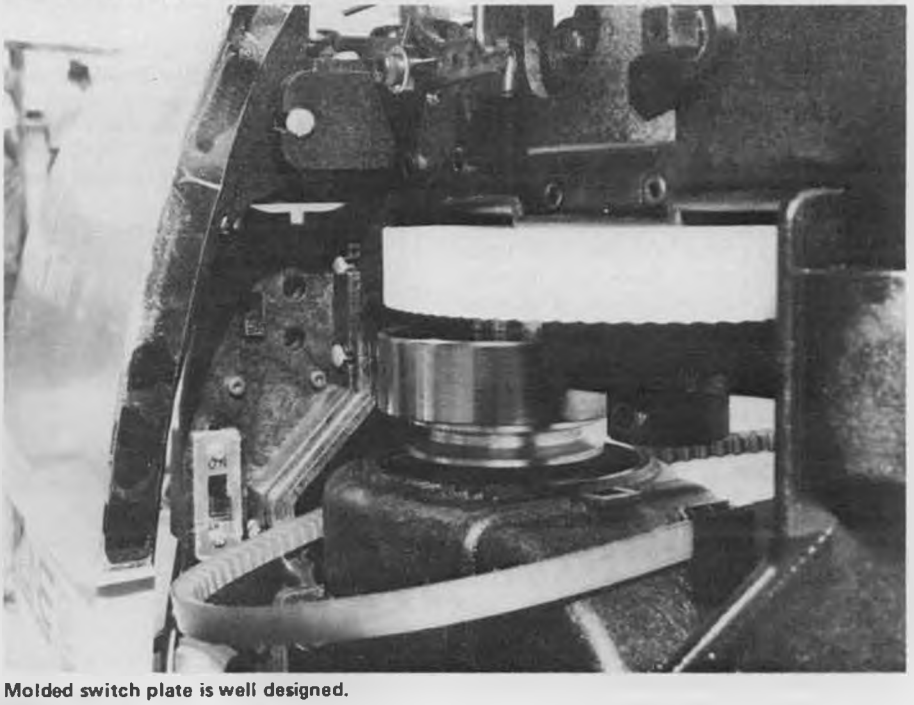
The Cyclone has a number of tried-and-true components borrowed from the Baron 50 and 60 models. The one I tested had the KSB-4 rotor head, which uses a flexing metal plate to provide dampening to each blade individually. I had used a similar version on a Baron 50 I owned about five years ago, and I remember how smooth my chopper flew. I understand that the head is being replaced by the KSB-1, which is more rigid and has a built-in coning angle. That's also a quality rotor head, and is a little tougher. Kalt makes a complete line of rotor heads, and if you want to try something different, you have many to choose from. The fuel tank is the best I've ever seen, actually "overbuilt" for what reason I don't know. It has two polished aluminum stoppers, one of which is threaded for a number four bolt, and a rubber stopper with a flange that completely seals the opening. The tank is as tough as any I have seen and should be one of the things that will survive in a crash. The tail blade holders are supported by two ball bearings and, again, are better than you'd expect on a helicopter this cheap.

I had a problem with the tail pitch control lever, which is an "L"-shaped rod about 2mm in diameter. It was slightly bent and wouldn't move smoothly through the tail gear box. I replaced it with a harder piece of .078 music wire. I also replaced the nylon pitch control plate with the Kalt ball bearing version for my own peace of mind!

I think we're benefiting from having components from the top of the line Baron 50 and 60 that have found their way into this kit. As I mentioned before, the inline swashplate comes completely assembled, as does the rotor head, upper plate lock, mixer, and radius support. The rotor blades

*Continued on page 96*

Dwight Shilling nose to nose with the Cyclone.



Molded switch plate is well designed.

Throttle lever extension is a nice extra on the Cyclone.

High quality, all-metal rotor head, mixer and swashplate, all factory assembled.

# BIG BIRDS

By AL ALMAN

Bruce Gale running a safe fly-in from the best vantage point, the control tower.

• My recent stay in the hospital brought me into more direct contact with non-modelers than I've had in years, and it was an eye-opener.

I know that I've grown to intensely dislike the sound of our screaming two-cycle engines because mufflers have been inadequate and because we've neatly compounded the problem by boring out these same mufflers till they're nothing more than absolute pieces of junk hanging on our engines.

What I'd almost forgotten was how much more vehemently the average non-modeler feels about these very same screamers of ours, and the word they all too often use is *hate*! A typical response was, "I'd just love to shoot those damn planes down, maybe then they'd go away and take their noise with them." Further questioning revealed that all three of the individuals I'd talked to resented the noise inflicted on them because they felt little or nothing was being done by the modelers to be good neighbors.

These three guys, who live in different areas and are being affected by different clubs (one of them being a control line bunch), made the same basic complaint: that any attempts on their part to reason with the people involved met with a total lack of interest. Because these clubs either owned the land they flew on or had some other sort of firm grip on their flying sites, they refused to negotiate; their very stupid attitude being, "It's our land and we'll damn well fly here whenever we want, so you can go to hell." I won't be surprised when I hear that all three clubs have been served with injunctions that prohibit their flying. And as far as I'm concerned, the sure-to-follow crying that they've been treated unfairly will fall on deaf ears. By refusing to try to coexist and get along with non-modelers who have a reasonable complaint about noise, these club members mark themselves as being exceptionally S-T-U-P-I-D, and they deserve to lose their flying sites.

My only concern is that the bad image projected by these clubs will taint the rest of us who recognize that there is a potential problem and are willing to work it out.

Remember that the only thing harder than finding a flying site is keeping one.

**SEAMASTER 120**

Ace R/C's Seamaster 40 was a BIG hit. So BIG, in fact, that Tom Runge decided they should prototype a Seamaster 120 for their Float-Fly in June. How well did this bird do? The answer comes straight from Tom:

"What a majestic bird! I thought the 4-120 Bipe was a kick to fly, but this plane really is my favorite. Maybe there is something to this BIG Bird thing! Yes, we will kit it. Die drawings are done and things are progressing. Sometime this winter we will release it.

Plans for this 78-inch quarter-scale Spacewalker are available from Dry Ridge Models.

Ken Rowe's scale Dornier flew well with two O.S. Wankels for power.

Bert Baker's nice-looking Piper Skycycle. Bert intends to kit this 15 pound, 80 inch bird, and flew his with an O.S. 240 twin.

"I'll keep you posted on progress. We've been going through a big expansion and as with anything of this nature, if it only takes twice as long as you think it should, you're lucky." I know there are a lot of us 4-120 Monoplane and Bipe buffs out there, so this info should make a lot of folks very happy. Being aware of the kind of problems that can jump up and bite a kit manufacturer in the tush and because Ace has got a solid reputation for quality, I figure that "winter" means the early part of '89. I'm writing this on August 29, so I know that I've got at least a five-month wait. It must be wonderful to have patience.

**PLANS ENLARGING SERVICE**

Concept Technology's David Bessel lays it right on the line so that there's no misunderstanding about what Concept can, and can't, do. Bessel sez:

"We specialize in giant-scale projects. No plane is too big and no source drawing is too small. Any 8 x 11-inch three-view of a single-engine plane can be enlarged to quarter or larger scale." This is a precision plan enlarging service. Original plans are scanned in a computer, mathematically enlarged, and then redrawn on a computer output unit.

According to Bessel, this process is extremely accurate, avoiding the distortions inherent in the optical enlarging technologies previously available, and the service is fast and economical.

I like the part about being fast and economical, especially if Concept can insure consistent quality.

So, if you've got anything you want scaled up, contact David Bessel, Concept Technology, P.O. Box 669, Poway, California 92064; (619)486-2464.

**POURING CA GLUE**

Some months ago I mentioned about pouring Hot Stuff from quarter-pound bottles into easier-to-handle two-ounce containers. Got a note from Satellite City's Bill Hunter (he's the Hot Stuff Man) explaining how to avoid any spilling:

"I noticed in the last BIG Birds your suggestion about pouring the four-ounce into the two-ounce for easier dispensing. I hope the readers have steady hands. One can make a mess really quick if one gets distracted.

"Perhaps it would be better to leave the spout on the four-ounce and just cut it back for a large opening, but long enough so that it goes inside the neck of the two-ounce while refilling. That way the two-ounce can't tip over and, in the case of Special "T," the glue doesn't have as much chance of being poured over an air bubble and gushing over the top." Good point, Bill. That is the way that I did it but forgot to include that info when I wrote it up.

**QUARTER-SCALE SPACEWALKER**

If you like Jesse Anglin's Spacewalker but find that Sig's nine-footer is just a mite too BIG, why not give Dry Ridge Models Quarter-Scale Plans a try.

Emil Agosta's first two sets of plans, the J-3 Kitten and the J-4 Sportster, were nicely done, so I'm sure that his latest release, a 78-inch Spacewalker, reflects the same high

*Continued on page 80*

Benny Phillips' 96-inch Super Lazy Ace, powered by a Quadra 50.


Dave Weignadt resting in the shade with his Big 98-1/2-inch Laser. A most impressive performer with a Sachs 3.5 engine for power.


IMAA events are non-competitive, so these prizes were awarded to the youngest pilot, the oldest, and the flier who traveled the longest distance to the meet.

# Simply Scale

By CLIFF TACIE

• For those of you who attended the '88 Nats at Fentress, you don't need me to tell you, we had an excellent turn out for scale. In spite of the unfortunate cancellation of the regular outdoor free flight events, Indoor Free Flight Scale and Outdoor Free Flight Scale enjoyed a good turn out with some excellent models. Control Line Scale and R/C Scale both ended up with a high registration and featured some of the best models and most realistic flying seen in some time.

I mentioned in a previous column that I worked as R/C Scale Event Director this year. I am sincere in my efforts to help those modelers new to competition in selecting the maneuvers they should perform. There is no fun in the event for these modelers if they feel overwhelmed or intimidated by all the rules and regulations. Anything we can do to help them along the way is another step in promoting and supporting the growth of scale modeling.

As part of the sign-in package for R/C check-in, we distributed a sheet of sample flight routines, giving examples of several different types of flight plans to use with various aircraft. One of the series of maneuvers listed under the Light Aircraft-type plan was Straight Flight Out, Procedure Turn, Straight Flight Back. Since we had a large entry of Light Aircraft-type models, this turned out to be a popular combination. I had at least one flight judge in R/C Scale relate to me that if he saw "one more sequence of Straight Flight Out, Procedure Turn, Straight Flight Back," he was going to go crazy! I guess I have to take some of the blame, if you want to call it that, for his frustration, but from my own standpoint (and I'm sure that particular flight judge would agree with me), I feel it added to the realism of the event. For once, we didn't see Piper Cubs, Citabrias, and Aeroncas trying to perform maneuvers which, though perhaps within their performance envelopes, were unprototypical.

Outstanding among the realistic flights were those presented by Mark Harrell with his Sig Clipped-Wing Cub. As a matter of fact, Mark was awarded the NASA (National Association of Scale Aeromodelers) Flight Achievement Award. I didn't have a chance to see many of the flights during the competition, since I was running back and forth between flight lines much of the time, but I deliberately took the time to watch one complete flight on this Cub, and we would all be hard-pressed to do a better job of realism.

Another handout provided at the time of static judging for C/L and R/C was a Craftsmanship Declaration. Each contestant was required to fill out this form and include it with his documentation for static judging. This form proved extremely valuable to the static judges because for once, all declarations were in the same format and contained the information pertinent to judging the model for craftsmanship.

One modeler was concerned that we provided and required these forms, since in his view, the rule book requires the modeler to provide his own declaration, and he felt that if a contestant didn't read the rule book or follow the rule book correctly, it was his own tough luck if he was downgraded because of it. His point is understandable, but the object in providing the forms was to help make the judging easier for the judges and help make information provided more uniform.

In reading back over the rule book, paragraph 4.6 of R/C Sport Scale says, "The contestant will provide a signed declaration for

An extremely tough competitor in Giant Scale is Tom Czikk of Merrick, New York. His beautiful P-40C finished third in the closely contested event. Photo: R. Sears.

A Spezio Tuholer by Dennis Hernandez. Entered in R/C AMA Precision, it was built from author's plans, and got the highest score in the event. Photo: Sears.

This Howard DGA by Mike Welshans of Royal Oak, Michigan placed fourth in C/L Sport Scale at the Fentress NATS. Photo:Sears.

the judges which will list the major components of the model the builder of the model did not make himself." It seems clear that this doesn't say the modeler can't be provided with a blank form to use. It's his responsibility to fill out the form and submit it signed to the static judges.

Keep in mind, guys, some modelers out there are not as adept at putting things down on paper and formatting them in an organized manner as others may be. As Contest Directors, we owe it to the modelers participating in our contests to make it as easy as possible for them to compete on the basis of their modeling skills, not their literary competence.

At any rate, I hope all who attended enjoyed the Nats, and we'll hope to see you next year.

**TOP GUN**

The ultimate in scale competition is the FAI World Championships or maybe the Scale Masters, right? Well, maybe. There is now yet one more event vying for the prestige afforded these other top-of-their-class events.

It's called Top Gun (officially "Top Gun Invitational Tournament"), and it's being sponsored primarily by the city of Coral Springs, Florida, a small town just northwest of Fort Lauderdale, and the Coral Springs Jaycees. April 21, 1989, is the date, and the field of the Condors R/C Club of Coral Springs is the place.

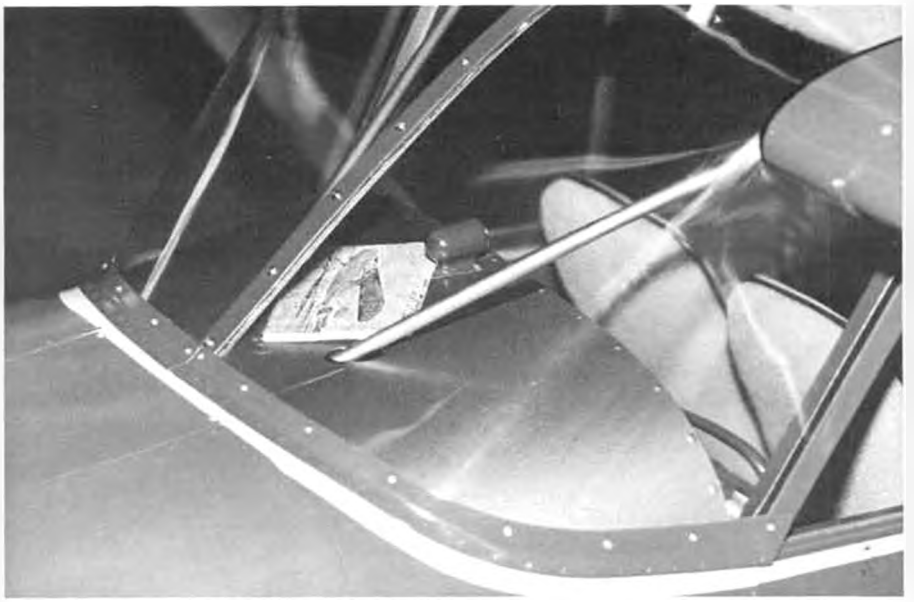
The invitational event has been conceived by Frank Tiano and Dave Platt with the intention of once again bringing together a contingent of the best scale modelers in North America, and it is meant to compliment, not compete with, the prestigious Scale Masters Event. Somewhere between 40 and 50 top quality modelers from across the nation will be invited based on the results of a 40-question screening, which will insure he is indeed the "best of the best," and not just lucky enough to have qualified at perhaps a low-attended qualifier. (This doesn't happen often in the Scale Masters program, but the idea of an invitational eliminates such an instance altogether.)

Cash prizes will be awarded. Give the organizers of this event credit; they have published a rule book which will govern the event and have distributed it to each invited competitor. There should be no questions what the rules will be and how they will be enforced.

My personal opinion is that this event will, indeed, compliment the Scale Masters program. Scale Masters finals are usually held in September or October, and Top Gun is to be held in April; no conflict there. It certainly won't steal competitors away from the Scale Masters, since it's an invitational, and won't present qualified competitors with a decision as to what event to attend. If qualified and invited, attend both! In looking at the rule book, the same type of aircraft are eligible for each event, so no one should be caught in the old trap of having to build a special model for a specific event.

Top Gun officials are promoting the

*Continued on page 75*



This is a world-class model! Steve Sauger's First Place FAI Scale Aeronca Sedan has a miniature replica of the EAA magazine with the full-size aircraft's photo on the cover! Photo:Sears.

**LIGHT AIRCRAFT TYPES; Cubs, Aeroncas, Taylorcrafts, etc.**

| | | |
|---|---|---|
| 1. Take Off | Mandatory | Upwind |
| 2. Flypast | Mandatory | Upwind |
| 3. Figure Eight | Mandatory | Upwind |
| 4. Straight Flight Out | Option | Upwind |
| 5. Procedure Turn | Option | Upwind |
| 6. Straight Flight Back | Option | Downwind |
| 7. Overshoot | Option | Upwind |
| 8. Traffic Pattern Approach to Landing | Option | Upwind |
| 9. Landing | Mandatory | Upwind |
| 10. Realism in Flight | Mandatory | Judged Throughout Flight |

**AEROBATIC LIGHT AIRCRAFT TYPES; Citabrias, Clip Wing Cubs, etc.**

| | | |
|---|---|---|
| 1. Take Off | Mandatory | Upwind |
| 2. Flypast | Mandatory | Upwind |
| 3. Figure Eight | Mandatory | Upwind |
| 4. One Axial Roll | Option | Downwind |
| 5. One Inside Loop | Option | Upwind |
| 6. Four Point Roll | Option | Downwind |
| 7. Stall Turn | Option | Upwind |
| 8. Three Turn Spin | Option | Upwind |
| 9. Landing | Mandatory | Upwind |
| 10. Realism in Flight | Mandatory | Judged Throughout Flight |

**MILITARY FIGHTER TYPES; P-51, P-47, etc.**

| | | |
|---|---|---|
| 1. Take Off | Mandatory | Upwind |
| 2. Flypast | Mandatory | Upwind |
| 3. Figure Eight | Mandatory | Upwind |
| 4. One Inside Loop | Option | Upwind |
| 5. One Axial Roll | Option | Downwind |
| 6. Split S | Option | Upwind |
| 7. Retract & Extend Flaps | Option | Ground Demo |
| 8. Retract & Extend Gear | Option | Ground Demo |
| 9. Landing | Mandatory | Upwind |
| 10. Realism in Flight | Mandatory | Judged Throughout Flight |

**MILITARY BOMBER TYPES; B-25, B-17, etc.**

| | | |
|---|---|---|
| 1. Take Off | Mandatory | Upwind |
| 2. Flypast | Mandatory | Upwind |
| 3. Figure Eight | Mandatory | Upwind |
| 4. Procedure Turn | Option | Upwind |
| 5. Bomb Drop | Option | Upwind |
| 6. Multi-Engines | Option | Demo Throughout Flight |
| 7. Retract & Extend Flaps | Option | Ground Demo |
| 8. Retract & Extend Flaps | Option | Ground Demo |
| 9. Landing | Mandatory | Upwind |
| 10. Realism in Flight | Mandatory | Judged Throughout Flight |

# Control Line

BY JOHN THOMPSON

• Control line flying is fun, no matter whether you do it just for relaxation with a Ringmaster on Sunday afternoons or whether you are striving to represent your country at a world championships.

Some fliers never desire to do anything but fly pretty airplanes on Sunday afternoons, and most who go into competition still find that to be among their favorite activities. But others find themselves looking for new challenges in model aviation, and competition provides many such challenges, as well as some frustration for the flier who's trying to get started on the contest trail.

This is the first of several columns that will discuss some of the ways that control line fliers can begin moving into the exciting world of competition flying. I will concentrate on the types of events most suited to beginning in competition.

We'll start out the series by taking a look at racing, the form of competition in which novices find the most chance for success early on. Many fliers move from racing into other areas, and some find racing to be a lifelong passion.

Racing is a good starting place in competition because at its entry level it requires the simplest of piloting skills, and there are several classes that require only simple equipment. But it provides ample challenges and room for improvement. It seems that when one has mastered a level of racing, there's always a tougher one to conquer.

As opposed to some of the events, such as combat or aerobatics, that seem to require a particular talent to emerge as a top competitor, there's no aspect of flying or pitting a racing plane that can't be learned with practice (with the possible exception of Rat Race, which requires an unusually high level of athletic skill and strength).

Paul Gibeault from Calgary pits a mouse racer. Joe Armstead at work in the background.

The pits are busy at the 1988 Goodyear NW regionals.

Pitman Ron Salo from Vancouver, B.C., calls pilot to pit stop. Photo: Paul Gibeault.

In fact, it must be said early and often that the most important aspect of racing is *practice*! When we speak of practice, we are talking about both practice at your home field on a regular basis, as well as practice gained by entering and flying in as many contests as possible. It is a good idea if possible to find a partner who also is interested in racing because two people practicing and competing as a team will progress faster than one person alone.

In regard to the partnership concept, racing also is an excellent activity for parents and their youngsters or for modelers who like to work with young people or beginners. Dad in the pit crew and son or daughter in the pilot's circle is an excellent teaming.

Let's take a general look at racing and then examine some of the particular kinds of racing that are available on the competition trail.

**WHAT IS RACING?**

Interestingly, one of the most common questions heard from spectators at CL contests, upon viewing a race, is "What are they doing?" The object of the activity is, in fact, a little obscure to the spectator but becomes quite exciting to the CL fraternity. Like any racing event, it takes a little attention to keep track of who's ahead, but once you get used to the flow of the competition, it's intriguing.

Racing CL airplanes is much like any other kind of racing: the planes simultaneously fly a measured distance, and the first one there wins.

The only way to *really* know the intimate details of racing rules and regulations is to study your AMA rulebook. The Academy of Model Aeronautics is the governing body for model aviation, and membership is re-

**Simple front end of a sport racer, typical of the style. Note alligator-type uniflow vent pinchoff. Power is a Fox Stunt .45.**

quired for competition. The rulebook is available on request at no charge from AMA (it no longer is automatically sent to all members). The rulebook has rules for Rat Race, Slow Rat Race, Scale Race (Goodyear), Mouse Race, 1/2-A Scale Race, and FAI Team Race. It also has a section of general racing rules that apply not only to all AMA events but to most of the "sport race" type events that are peculiar to various regions of the country. Obtaining and reading the rulebook should be your first step in getting started in racing.

Because of the limitations of the circle, the number in a heat is normally from two to four airplanes, so it takes quite a few heats of racing to determine a winner.

Races consist of preliminary heats, usually half the distance of the feature race. For example, most events having 60-foot lines (Rat Race, Sport Race, Goodyear, etc.) have 70-lap (5-mile) preliminary heats and a 140-lap (10-mile) feature.

The "starting line" for each plane is the point on the circle where its pit is located. The finish line is the same, the prescribed number of laps later. The start is "cold," meaning that the pit crew starts the engine and launches the plane after the "go" signal.

One or more timers, each equipped with a lap counter and stopwatch, is stationed at each pit. In very competitive racing, such as the very close Northwest Super Sport Race that is popular in the Pacific Northwest, planes often will finish on the same lap, and the crews and spectators will be intently watching the timers, posted at each pit area, to see when they click their stopwatches.

In important national or regional championship races using a strict interpretation of the AMA rules, each competitor will fly two back-to-back preliminary heats, with the times added together and the lowest combined times advancing to the feature (the number of feature heats varies from one to several, depending on the number of entries and/or local tradition).

Many contests, particularly local contests with several events on the schedule, will run only single preliminary heats (instead of the double back-to-back heats), with the lowest times advancing to the feature.

In this writer's opinion, the most interest-

**Marty Higgs of Vancouver with a typical rat racer.**

ing type of racing format is the "round robin," such as used in the Northwest Sport Race Drizzle Circuit, in which the finalists are selected on the basis of *placing* in the heats, with times used only to determine heat placing and to break ties.

All CL racing involves mandatory pit stops, in which planes must be refueled and restarted. Usually, the requirement is one pit stop for a preliminary heat and three for a feature race.

Obviously, the requirement for pit stops makes racing a team event, with the key members being the pilot and pit crew chief. Many racing teams choose to use a third member (a second pit crew hand).

The expense, and to a very small degree

**Californian Joe Armstead with his Goodyear plane.**


**A mouse racer with metal wings by Mike Hazel, Nitroholics Racing Team. Photo: Hazel.**

the difficulty of piloting, in racing events was reduced with the requirement in 1986 that all racing (except in the 1/2-A classes) would be done with contest-supplied 10-percent nitromethane fuel. This eliminated the need to buy or make expensive fuels up to 50-percent nitro, and it extended engine and glow plug life considerably.

Next, we'll look at some of the different racing classes, and after that we'll examine the requirements of building, pitting, and piloting. The first two, Mouse and Sport, are the ideal beginner events.

**MOUSE RACE**

Mouse racing is the smallest, cheapest, and one of the easiest forms of racing to get started in, but it still presents a challenge that keeps many of the old "pros" interested.

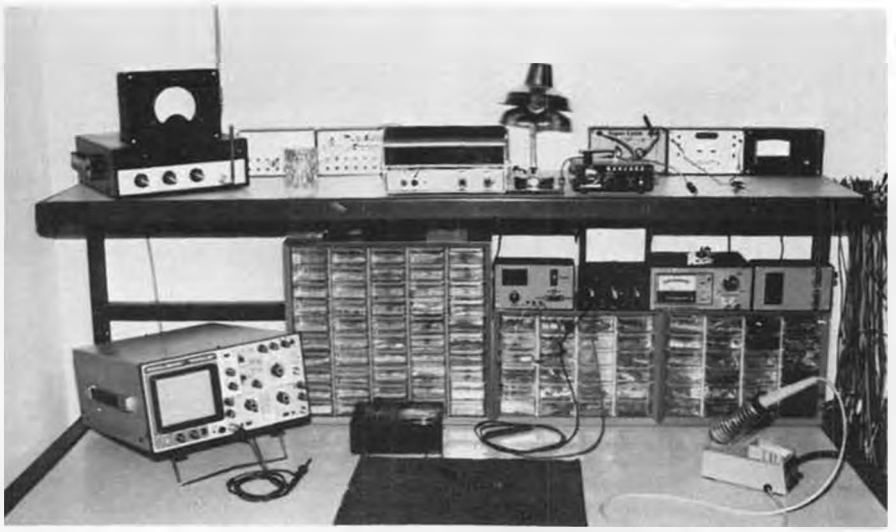
Mouse is divided into two classes, I and II. They are flown on 42-foot lines, .010-inch single-strand or .012-inch braided.

Class I Mouse race requires use of reed valve engines with integral tanks, and bellcranks must be external. Airplane design is otherwise open to the creativity of the builder. Naturally, the Cox .049 engines are the basis for most racing engines, but there are some "tricks" that can be used to go faster than the hobby shop Cox. The easiest and probably the best trick is to mail off to Kustom Kraftsmanship for one of Joe Klause's custom reed valve racing engines, which are based on the Cox Black Widow but are considerably faster out of the box. (Send $1 to Joe for a catalog. It's Kustom Kraftsmanship, P.O. Box 2699, Laguna Hills, California 92653.)

The beauty of this event is that the engines are easy to start and tune, the planes don't require any superhuman strength to fly, and anyone from kids to senior citizens can handle them. There's not much investment in the airplanes, and they tend to be repairable after crashes. The engines, even the $40 KK custom engines, are comparatively inexpensive and long-lasting.

There are a number of excellent Class I designs around in published form (see the plans listing of model magazines), and a few kits still can be found in hobby shops that will work for mouse race. Or, you can simply attend a contest, take a measuring tape and a pad and pencil, find the quickest-looking mouse racer, measure its key dimensions, and draw a picture or take

*Continued on page 64*



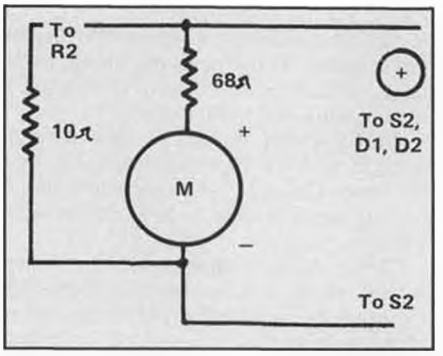
# Electronics Corner

By ELOY MAREZ

• We're starting this month with a history lesson! It may possibly be a bit off the subject, but then since when do we stick 100 percent to the subject here in EC? Actually, it is not too far off, as it does have to do with R/C, being further proof to the contrary to those in R/C cars who are firmly convinced that all radio control started with the Associated RC10.

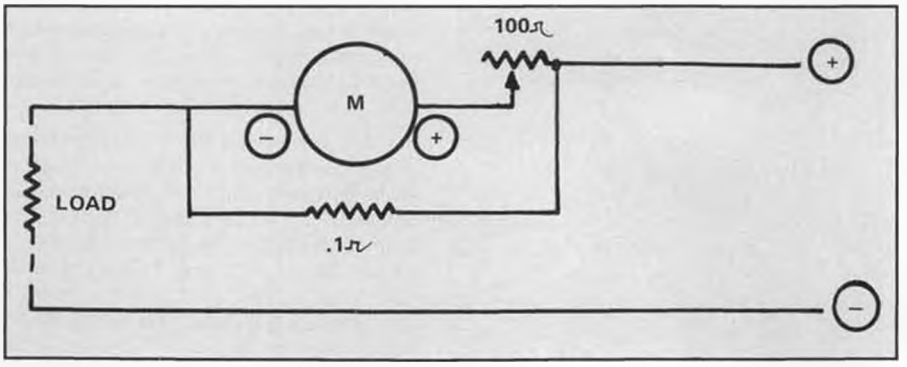
Anyway, the very first R/C target drone, one designated as the "JH-1" was first flown over 50 years ago, being used in actual target practice for the first time on August 24, 1938. No, I wasn't there; no doubt I was too busy trying hard to beat my best time of ten seconds on my latest rubber-powered cabin model.

About all I can tell you about the R/C gear is that it *wasn't* PCM, and it *wasn't* solid-state. Actually, the first such equipment I ever saw was in 1949 or so and was used to fly the later Ryan target drone, which was powered with a huge version of an engine I knew well, the Ohlsson and Rice. All I remember now is the control box, which was a large aluminum box with a rubber-




**Ace R/C's circuit for using low value reading milliameter to measure higher currents. This circuit is used in Ace DMVC charger.**

supported stick free to move in four directions. The inside end of the stick closed one of four micro-switches when moved off center. Obviously, the system was non-proportional, though whether it was on-off such as we later had in reed systems, or merely trimmable, I don't know. The equipment might have been crude by today's standards, but it reached a level of sophisti-




**Bill Klein's circuit to convert Radio Shack's 15 VDC meter into a 1.5 amp ammeter. Text contains formula used to obtain values.**


**The Shinwa Pumper Extra 18 is a self-contained unit providing all normal field requirements. It outputs 18 volts to the starter for balky or larger engines. For info, write Andes Hobbies, Box 3077, Laguna Hills, Calif. 92654.**

cation adequate to fly a full-size B-17. I did see that once or twice, probably more often and didn't know it, flying around Eglin Field in Florida, probably in the early fifties.

**ON TO NEWER THINGS**

First off, in answer to a number of requests, I have managed to dig up a 12-volt battery charger circuit for you, to help you revive those wet- or gel-cell starter batteries.

It is not too complicated, as far as this type of circuits go, using only two transistors and one Silicon Controlled Rectifier (SCR). However, it has some pretty desirable features, charging the battery at two amperes until a preset level is reached, at which time it automatically switches to a lower "trickle" rate of approximately 150 milliamperes. There are no really unusual parts, though you will have to depend on a decent-sized electronics supply house or one of the large mail-order services for all of the bits and pieces.

The circuit comes with a good description of what it does and how it does it. Your copy is waiting for you, just don't forget to enclose a SASE with your request.

**SILICON-CONTROLLED RECTIFIER?**

What's he talking about? Well, we discussed SCRs rather briefly earlier this year. They are but one of the family of semiconductor devices known as "thyristers." The SCR is basically a four-layer device with three electrodes; an anode and cathode similar to any other rectifier, and a third one known as a gate. It can be made to change from a nonconducting to a conducting state by the application of the proper control voltage to its gate. Each type of SCR is different in its voltage and current handling capabilities and its gate voltage requirements, so I can't give you operating parameters that will work in all cases. However, such information is available in the hundreds of manuals and spec sheets published by the appropriate manufacturers.

Effectively, one can think of an SCR as a relay, or even as a switch. Like those better-known components, its action is to turn something on or off.

**LETTERS**

Following last month's discussion about analog meters, there are a couple of letters I would like to share with you. The first comes from a previous contributor, William Klein, of Allentown, Pennsylvania, and reads:

"Again, Eloy, just a little something for anyone who might be interested. It was just

*Continued on page 94*

# PLUG SPARKS

By JOHN POND

• The weather in Indiana in July was no great surprise as the 1988 SAM Champs featured the usual hot weather and high humidity. Despite the fact the Midwest had been suffering from a long drought, the contestants were greeted on Tuesday by rain that lasted on and off all day.

The Champs, held at Lawrenceville Airport, were fortunate in being able to utilize the eastern end of the airport for both R/C and F/F. This is particularly noticeable in Photo No. 1 showing George Armstead, of Glastonbury, Connecticut, about to launch his Super Cyclone-powered Jasco Flamingo as designed by Roger Hammer.

Before going much further, this writer would like to acknowledge the unselfish work of Harold Johnson (the official "unofficial" SAM Photographer) and Bill Pierson, who shot most of the radio control entries.

The contest itself ran very smoothly thanks to the hard work of Don Sachtjen, Chairman of SAM 37 sponsoring Chapter, and to Bob Larsh, Mid-West SAM VP, who also acted as Contest Manager. As Don put it, "This contest was a hectic, amazing, and enjoyable experience that left us with many fond memories." Unfortunately, we did not get any photos of the officials, but we will run them in future issues as we receive them. We have already run a good photo of Willard "Buck" Zehr, the R/C Director, so it is a pleasure to present Photo No. 2 taken by Bill Pierson of that hard working R/C crew, Mike and Dorothy Granieri. Needless to say, the power behind the throne, Dorothy, did a fine job of frequency pin regulation. No reports of any conflicts and/or "shoot-downs." Great from an R/C flier's viewpoint.

Although the drought ruined the corn crop, the majority of corn still reached a height of three to four feet fully "tasseled out." This made for a problem for the free flighters if you weren't right on top of your model when it landed.

The eventual Overall Free Flight Champion, John Bortnak, was practically out of his mind as reports had it that he had as many as nine models in the corn fields at one time! Certainly a tribute to his perseverance.

Somehow or another, Johnson didn't get a shot of Bortnak, so we used last year's Photo No. 3 to show what this Canadian "strong man" looks like. On the other side of the coin, last year's Free Flight Champion, Clarence Myerscough, is seen in Photo No. 4. For a change, instead of his faithful Playboys, Clarence selected the Shulman Tambe (called the "Sky Scraper" in the *Model Airplane News* plan).

Shulman designed this deep-bellied model to accept all motors from Ohlsson 23 to Brown Jr. in order to compete in all classes with one model. This particular model features a Torpedo 29, which makes a real performer of the Tambe. As they say, "Close, but no cigar." Getting on with the photos, this Champs was noticeable for the tremendous amount of rubber power model activity. With no less than six major endurance events, entries ran as high as 53 for the Small Rubber Stick Event. The Pre-1937 Wakefield Event also drew well as seen in Photo No. 5 showing George Batiuk in that last tense moment just before launching with a fully wound motor. George had tough luck in this event, ending up eleventh in a very tough field of competitors.

George comes from Huntsville, Alabama, where he has worked on government contracts for many years. George tries to make all the SAM Champs, work permitting.

One of this writer's favorite characters is Don Garafalow, seen in Photo No. 6, holding a "Yellow Bird," a 1940 Scientific Model Co. kit. For years, Don and Ed Franklin used to come to the early SAM O/T Events at the Nationals dressed up fit to kill. This writer can still remember Ed trying to start his

2. The R/C helper crew, Dorothy and Mike Granieri; very hard workers!

3. The 1988 Free Flight Champ, John Bortnak, of Calgary, Canada.

1. George Armstead with Cyke-powered Flamingo is a contestant this time. He ran two previous Westover AFB SAM Champs!

A Shulman Tambe by Clarence Myerscough, Torpedo 29 power.

5. George Batiuk in a tense moment with his Verdier Canadian Wakefield.

Mighty Midget engine in a T-D Coupe design. Wearing a stove pipe didn't help either!

It truly was a shame when Ed Franklin got caught in an electrical explosion. Don really misses his buddy. A short word about Don is in order:

Most modelers are not aware of the fact that Don did most of the drawings for John Frisoli of Scientific Model Airplane Co. One can carefully scan the Scientific Co. drawings and never find any draftsman name, initials, etc., as Frisoli was extremely careful to remove any and all credit to the designer/draftsman. Don reports he thinks he actually sneaked one by on the "Larkey" drawing.

Don was most amusing in his reminiscence of old time kit work. Don was employed for a short time by Ed Schlosser of "Best-By-Test" kit fame. Don was fairly close to Ed and related some humorous yarns, unfortunately most of them unprintable under present liable laws.

Looking over the gas entries in the "Slag" Engine Event was fun. These "cheapier" type engines are tough enough to get started, but to keep them running is another problem, as the aluminum parts expand so rapidly, engine compression is difficult to maintain.

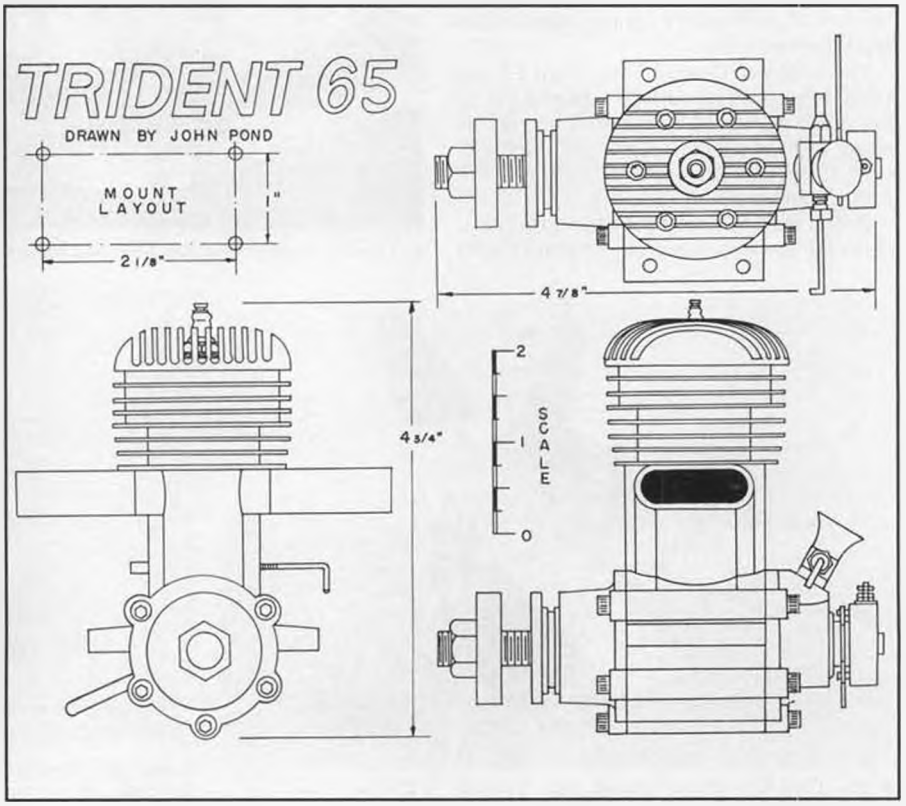
Karl Spielmaker (aka "Krazy Karl," Bearing Von Spielmaker, etc.) seems to have the knack with a Rogers KD-type engine seen in Photo No. 7. Most surprising of all appears to be the good running characteristics of this engine. This engine is mounted in another "cheapie" kit, the "Bullet" as put out by Mercury Model Co.

This design, if you can't recognize it, is another Ray Heit creation, a well-known gas modeler in the New York-Brooklyn area. At one time or another, Ray was designing kit models for all of the major model houses: Bay Ridge, Heathe, Capitol, Mercury, and Guillow; a prolific builder!

One of the recognizable features of Heit designs is the diagonal bracing of the fuselages. This is seen in the *Flying Aces* plans of the "Scram" and "Scrappy" (both of which are available from *Model Builder* plans service). This style was adopted by the Skyscrapers Club in such designs as the Topper, Taibi Powerhouse, and other Brooklyn designs (Rocketeer, Sky Rocket, etc.).

Ray finally moved to the Los Angeles

6. Don Garafalow, Teaneck, N.J., with one of the many designs drawn by him, a Scientific Yellow Bird.



7. A Rogers-powered Mercury Bullet by Karl Spielmaker, a wild combination! Photos:Johnson.

8. Eut Tileston's collection of winners: Lancer, Westerner, small Westerner, and a Scorpion. Photo: Pierson.

9. Eric Clutton flies what he sells, P.A.W. engines, like this one in his Red Zephyr. Photo:Johnson.

10. Bill Tibbs with good-flying Comet Clipper. Good for first time out!

area. You couldn't say the Scamps didn't try to get Heit back into O/T modeling. They tried hard! Seems like once they have lost their interest, it is very difficult to get the original old timers into the game.

We have been gassing enough, so let's get a few more photos in. Looking at the collection of models by Eut Tileston, Photo No. 8 shows all the models he flew and won with. Eut was able to win the Overall R/C Championship based on the excellent performance of his models. Good craftsman, good flier, and competitor!

Photo No. 9 is a beautiful shot of Eric Clutton's equally beautiful Scientific Red Zephyr. No need to say what Eric represents in his engine sales. The English P.A.W. (Progress Aero Works) engines are well marked on the model. Note the R/C field in the background.

Photo No. 10 is not the most exciting picture in the world, but it does show Bill Tibbs with his MKI Comet Clipper. His first time out in R/C competition at the Champs. Good-flying model!

Another R/C shot is Photo No. 11 of Walt Geary holding his excellent flying Sailplane. Note this portion of the field. No incentive to land there!

Just to show you we run pictures of rival columnists, Photo No. 12 depicts Joe Wagner (*MAN* columnist) and his young daughter Loren. Joe is holding a Cleveland Norseman. This design is part of a series of WWII commemorative designs put out early in the war to mark those countries under the yoke of Hitler and his Nazi cohorts. These were such models as Austrian Chivalry, Polish Valor, Netherlands Interceptor, et al. What most fellows don't know is that all wings and tails were alike. You could build all the models using only one set of wings and tails!

In years to come, you will be glad to review the results of the 1988 SAM Champs. There are so many events, if we were to list all entered, we would run out of magazine. Because of that consideration, we will list only the first five places.

**FREE FLIGHT**

*.020 Replica* (74)

| | | |
|---|---|---|
| 1. Kevin Anderson | (Interceptor) | 600 |
| 2. Gene Wicks | (Interceptor) | 572 |
| 3. Gil Robbins | (Interceptor) | 514 |
| 4. John Shifko | (Ranger) | 408 |


11. Walt Geary seen with dandy-performing Comet Sailplane. Photos: Pierson.

13. Barney Onofri seen in the early days with a parasol version of the Trenton Terror.


14. Bud Perry, posing in 1973 with his beautiful scarlet and yellow Gladiator.

| | | |
|---|---|---|
| 5. Bill Hale | (Foo-2U2) | 360 |
| **30 Second Antique** (33) | | |
| 1. Mitch Post | (Clipper/Orwick) | 548 |
| 2. Bob Bissett | (Rambler/OR 60) | 358 |
| 3. Herb Wahl | (Clipper/Bunch) | 347 |
| 4. C. Myerscough | (Tambe/Torp 29) | 334 |
| 5. George Murphy | (Ehling/Atwood) | 324 |
| **Wakefield Pre-1937** (26) | | |
| 1. K. Spielmaker | (Duplex) | 742 |
| 2. Joe Macay | (Rushbrooke) | 697 |
| 3. Ed Wallenhorst | (Lanzo Duplex) | 517 |
| 4. R. Tompson | (Wriston) | 491 |
| 5. C. Hermanek | (Jeffrey) | 359 |
| **Twin Pusher** (25) | | |
| 1. E. Wallenhorst | (Simmers) | |
| 2. Bob Moulton | (Zaic Streamliner) | |
| 3. Otto Kurth | (Simmers) | |
| **Compressed Air** (10) | | |
| 1. Jim Noonan | (Noonan) | 236 |
| 2. K. Spielmaker | (Drone) | 107 |
| 3. Bert Pond | (Bottle Baby) | 73 |
| 4. Ed Konefes | (Orig.) | 53 |
| 5. A. Italiano | (Orig.) | 7 |
| **Class A Gas** (40) | | |
| 1. C. Myerscough | (Spearhead/Elfin) | 360 |
| 2. Jim O'Reilly | (Cabruler/Bantam) | 331 |
| 3. Bob Edelstein | (So Long/Arden) | 319 |
| 4. Jim Robinson | (Cabruler/Bantam) | 316 |
| 5. W. Bartelt | (Hayseed/Bantam) | 302 |
| **Class C Gas** (41) | | |
| 1. Jim Walston | (Playboy/Atwood) | 559 |
| 2. John Bortnak | (Wasp/OS 35) | 456 |
| 3. C. Myerscough | (Playboy/OS 40) | 360 |
| 4. Hans Oschner | (Gas Champ/OR 60) | 342 |
| 5. George Murphy | (New Ruler/OR 60) | 337 |
| **"Slag" Event** (12) | | |
| 1. Bob Edelstein | (Ranger/Rogers) | 251 |
| 2. John Shifko | (Ranger/Rogers) | 248 |
| 3. Hans Oschner | (00S/Rogers) | 223 |
| 4. Harry Murphy | (Ranger/Rogers) | 180 |
| 5. K. Spielmaker | (Bullet/Rogers) | 143 |
| **Gas Scale** (10) | | |
| 1. Jim Adams | (Fokker D-8/Frog) | 526 |
| 2. Bill Hale | (Interstate/049) | 297 |
| 3. Mike Moskow | (Fokker D-8) | 99 |
| 4. John Bortnak | (Skyfarer) | 79 |
| 5. Warren Wiesenback | (Bathtub) | 21 |
| **Small Rubber Stick** (53) | | |
| 1. Ed Mate | (Gollywock) | 359 |
| 2. Jack Tisinari | (Kralak) | 352 |
| 3. Joe Macay | (Cassano) | 352 |
| 4. Don Reid | (Gollywock) | 343 |
| 5. Ed Konefes | (Homesick Angel) | 339 |
| **Large Rubber Cabin** (53) | | |
| 1. George Perryman | (Lanzo) | 1080 |
| 2. Bob Bissett | (Nelder) | 490 |
| 3. Bob Watson | (Lanzo) | 466 |
| 4. George Batiuk | (Lanzo) | 448 |
| 5. Les DeWitt | (Chatelain) | 345 |
| **Class A Pylon** (50) | | |
| 1. Jim Walston | (Stormer/Arden) | 661 |
| 2. Wayne Cain | (Playboy/Arden) | 561 |
| 3. John Bortnak | (Stratostreak/OS 15) | 447 |
| 4. Bob Edelstein | (Interceptor/Arden) | 360 |
| 5. Joe Beshar | (Fox/Bantam) | 342 |
| **Class B Fuselage** (42) | | |
| 1. W. Bartelt | (Hayseed/OR 23) | 570 |
| 2. Harry Murphy | (Dodger/OR 23) | 420 |
| 3. John Bortnak | (So Long/OR 29) | 405 |
| 4. C. Myerscough | (Dodger/OS 25) | 355 |
| 5. Jim O'Reilly | (Pacer/Torp 29) | 343 |
| **Large Rubber Stick** (47) | | |
| 1. George Perryman | (Lanzo) | 1070 |
| 2. Bob Bissett | (Heller) | 928 |
| 3. Ed Konefes | (Lanzo) | 917 |
| 4. Ben Cleveland | (Climber) | 847 |
| 5. E. Wallenhorst | (Ed's Stick) | 609 |
| **Ohlsson 23 Cabin** (27) | | |
| 1. M. Chamberlain | (Twin Cyclone) | 353 |
| 2. K. Spielmaker | (So Long) | 344 |
| 3. George Armstead | (So Long) | 326 |
| 4. John Bortnak | (So Long) | 298 |
| 5. Sal Taibi | (Dodger) | 275 |
| **Small Rubber Cabin** (50) | | |
| 1. John Bortnak | (Dynamoc) | 540 |
| 2. Jack Tisinai | (Wriston) | 363 |
| 3. Russ Timmons | (Miss Canada) | 339 |
| 4. Ed Konefes | (Crusader) | 339 |
| 5. George Perryman | (Jabberwock) | 332 |
| **Class B Pylon** (45) | | |
| 1. Ben Cleveland | (Zipper/Forster) | 528 |
| 2. W. Bartelt | (Alert/Torp 29) | 472 |
| 3. Ed Mate | (Ranger/OR 23) | 352 |
| 4. Dick Hall | (Wasp/OR 29) | 351 |
| 5. C. Myerscough | (Zipper/OS 25) | 350 |
| **Class C Fuselage** (40) | | |
| 1. Sal Taibi | (Dodger/OR 23) | 589 |
| 2. C. Myerscough | (Playboy/OS 40) | 471 |
| 3. Tom Lucas | (Playboy/Atwood) | 465 |
| 4. Cliff Betz | (Dodger/Forster) | 343 |
| 5. George Armstead | (Bombshell/OR 60) | 338 |
| **Rubber Scale** (34) | | |
| 1. Jim O'Reilly | (Puss Moth) | 299 |
| 2. Bob Moulton | (Interstate) | 290 |
| 3. E. Wallenhorst | (Alco Sport) | 281 |
| 4. Russ Timmons | (Puss Moth) | 279 |
| 5. John Bortnak | (Curtiss Robin) | 260 |
| **Commercial Rubber** (35) | | |
| 1. E. Wallenhorst | (Light 1933) | 356 |
| 2. Ed Konefes | (Convertible) | 355 |
| 3. Lewis Odum | (Miss Canada) | 351 |
| 4. Joe McCay | (Convertible) | 348 |
| 5. Jack Tisinai | (Korda Victory) | 315 |
| **Hand Launched Glider** (47) | | |
| 1. K. Anderson | (Hervath) | 360 |
| 2. R. Sharpton | (Cody) | 279 |
| 3. John Bortnak | (Zoomer) | 239 |
| 4. A. G. Anderson | (Christan) | 226 |
| 5. Terry Rimert | (Hervath) | 222 |
| **RADIO CONTROL 1/2A Texaco** (64) | | |
| 1. L. Davidson | (Playboy Jr.) | 1800 |

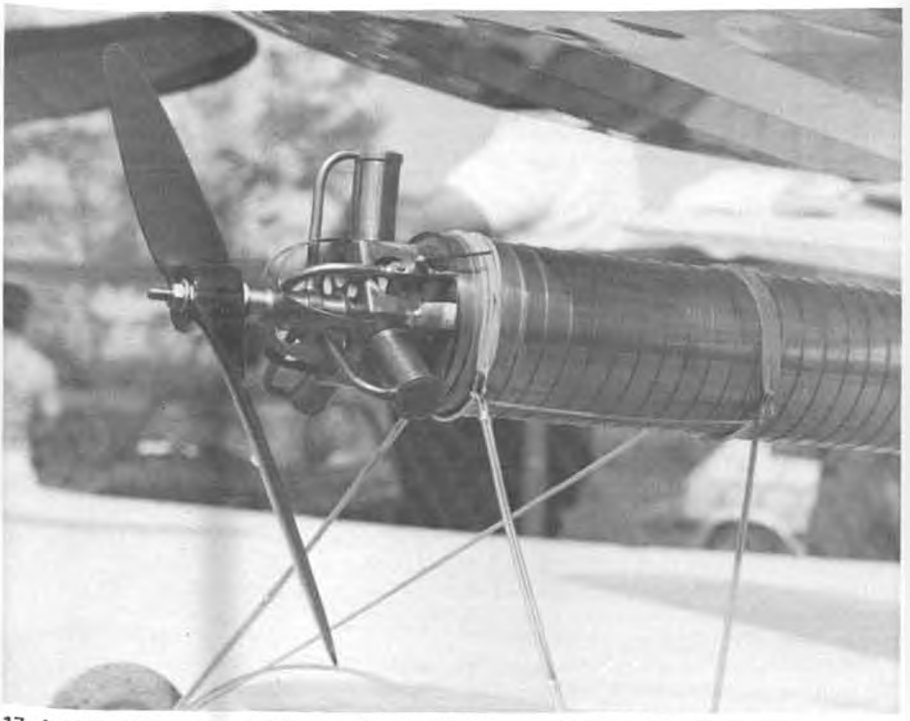
12. Joe Wagner and daughter, Loren, with the little-seen Cleveland Norseman for the small rubber cabin event. Photo: Johnson.

15. A Mickey De Angelis Kloud King is released by Hans Oschner. Power is a Maedwell 49.

16. A Chilvers Record Breaker faithfully reproduced by Dick Brace.

| | | |
|---|---|---|
| 2. Jack Warkins | (Mike) | 1711 |
| 3. D. Robinette | (Bomber) | 1688 |
| 4. Bob Langelius | (Miss America) | 1676 |
| 5. Don McCluskey | (Cal. Chief) | 1632 |
| **Texaco** (46) | | |
| 1. Ken Kullman | (Bomber/OS 61) | 2230 |
| 2. Art White | (Bomber/OS 60) | 1829 |
| 3. Chet Lanzo | (Bomber/Cyke) | 1816 |
| 4. Ken Hopkins | (Hopalong) | 1754 |
| 5. Walt Geary | (Bomber/Anderson) | 1450 |
| **Class A Ignition** (19) | | |
| 1. Art White | (Bomber/Elfin) | 1260 |
| 2. Jack Phelps | (Bomber/Arden) | 1253 |
| 3. Ken Kullman | (Bomber/Elfin) | 1120 |
| 4. Joe Percy | (Sailplane/Elfin) | 1103 |
| 5. John Pond | (Playboy/Elfin) | 990 |
| **Class C. Ignition** (52) | | |
| 1. Joe Percy | (Bomber/OR 60) | 1712 |
| 2. Eut Tileston | (Westerner/ Anderson) | 1647 |
| 3. Louie Faerman | (Interceptor/Cyke) | 1481 |
| 4. Dick Huang | (Playboy/Anderson) | 1198 |
| 5. Larry Jenno | (Kerswap/Edco) | 1035 |
| **Class B Glow** (23) | | |
| 1. Joe Percy | (Bomber/ST 29) | 1260 |
| 2. Eut Tileston | (Scorpion/KB 3.5) | 1186 |
| 3. Ralph Turner | (MG-2/KB 4.9) | 1166 |
| 4. Art White | (Bomber/KB 3.5) | 1157 |
| 5. Art Peterse | (Swoose/KB 29) | 1149 |
| **Class A Glow** (26) | | |
| 1. Eut Tileston | (Scorpion/KB 325) | 1146 |
| 2. Eddie Thomas | (Bomber/ST 23) | 1118 |
| 3. Walt Geary | (Playboy/OS 15) | 1105 |
| 4. Art White | (Bomber/KB 3.5) | 1069 |
| 5. Joe Elgin | (Playboy/KB 19) | 1069 |
| **Class C Glow** (46) | | |
| 1. Ralph Turner | (MG-2/KB 6.5) | 1746 |
| 2. Art Peterse | (Swoose/KB 35) | 1514 |
| 3. Eut Tileston | (Lancer/OS 40) | 1148 |
| 4. Art White | (Bomber/K&B 35) | 1100 |
| 5. Joe Percy | (Bomber/ST 35) | 1082 |
| **05 Electric** (11) | | |
| 1. Eddie Thomas | (Bomber/Astro) | 1073 |
| 2. Walt Geary | (Bomber/Astro) | 996 |
| 3. Robert Johannes | (Bomber/Leisure) | 840 |
| 4. Chas. Hill | (Playboy/Astro) | 764 |
| 5. John Pond | (Playboy/Sanyo) | 743 |
| **Antique C** (22) | | |
| 1. Dick Huang | (Cumulus/OS 60) | 2314 |
| 2. Al Grier | (Gas Bird/Rossi) | 2285 |
| 3. Joe Percy | (RC-1/ST 60) | 2174 |
| 4. Ken Kullman | (Bomber/St 60) | 1651 |
| 5. Ralph Turner | (MG-1/Rossi) | 1618 |

*Continued on page 102*



17. A 1935 Italian compressed air model, the ARV-8 as designed by Arve Mozzarini.

18. Tony Gallegos launces Oly Olson's Super Duper Zilch. K&B powers it.

# ELECTRIC POWER

By MITCH POLING

• Last month I presented Ed Westbrooks's way to find out what prop, voltage, and rpm you can get for your motor, from just two sets of motor run data. For those who missed last month's column, the equations to use are:

$E = I \times R + k \times rpm$.

E = motor terminal voltage, I = current in amps, R is armature resistance in ohms, and k is a constant that is a fixed number for a given motor.

You can find R and K using two motor runs with different props. You can solve by graphing E versus I, so R is the slope and k x rpm is the intercept, or you can solve by simultaneous equations. Once you have R and k, you can predict current, rpm, E, etc. using the above equation. Decide which values you will set, then solve for the last value. Besides all this, you can calculate:

Power output (watts) = $E \times I - I^2R$.

Power input (watts) = $E \times I$.

Percent efficiency = (power output/power input) x 100.

Last but not least, you can then calculate the pitch or diameter of the prop you want (choose one, calculate the other) to use with the equation:

Horsepower = $P \times D^4 \times rpm^3/1.4 \times 10^{17}$.

The conversion of watts to horsepower is 746 watts = 1.0 hp, so this is also going to be:

Power output (watts) = $P \times D^4 \times rpm^3/5.33 \times 10^{15}$.

By the way, in the last column I thought this equation might be too optimistic. However, on rereading George Abbot's article in the July '88 *Model Aviation*, I now realize that he clearly stated that this equation is for power *absorption* by the prop, not power delivered to the air. This means the equation is right on, and ideal for predicting prop sizes.

I ran these equations with Bob Kopski's data from the July '88 *MA* issue, presented here:

Table 2 Averaged (six motors) Performance for the Astro cobalt 15:

**TOP FLIGHT 8X4 WOOD PROP**

| Rpm | Voltage | Current |
|---|---|---|
| 9,000 | 7.7 | 8.4 |
| 10,000 | 8.7 | 10.2 |
| 11,000 | 9.8 | 12.3 |
| 12,000 | 10.9 | 14.6 |
| 13,000 | 12.0 | 17.3 |

I solved for k first using simultaneous equations and the data for 7.7 volts and 12.0 volts. I used the factor 17.3/8.4 to make the R term the same in both equations, then subtracted. k came out to be $6.97 \times 10^{-4}$. I ran this again with the 8.7 and 10.9 volt data and got $k = 6.74 \times 10^{-4}$. This tells me the method is working all right. Actually, the ideal is to take readings at no load and stall load, so I took the readings farthest apart as being the best, and used $k = 7.0 \times 10^{-4}$. I rounded off to a two-digit k because the input data was limited in the "worst case" to two digits (7.7 volts).

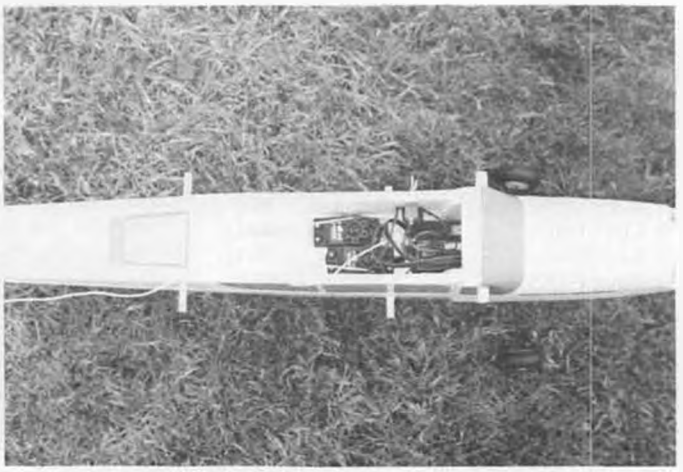
I used the same two runs (7.7 volts and 12.0 volts) to solve for R, using the factor 13/9 to eliminate k in the subtraction. R came out to be 0.17 ohm. This is the electrical resistance of the armature. Now we have the numbers for having fun! First for power out and power in. I used the data for 10.9 volts, there the power in is 10.6 volts x 14.6 amps = 156 watts. Power out is 156 watts - (14.6 amps) x .17 ohms = 123 watts. Efficiency will be (123/156) x 100 = 79%. This is a very good efficiency, by the way!

Now to check the propeller equation. We will want to use power out, so 123 watts/746 watts hp = .165 hp. Now use .165 hp = $P \times D^4 \times rpm^3/1.4 \times 10^{17}$. Let's set pitch at 4

*Continued on page 81*

**The Cox Hobbies' Electric Malibu, an excellent RTF model.**

**Malibu's gear and motor up close. Note left-hand rotation!**



**The two-channel Cox Cadet system installed in the Malibu.**

# TUCANO

**By ELOY MAREZ. . .Here's an ARF of an exemplary military trainer from Brazil that flies great with a .45 engine. It comes already painted!**


**Sport Scale at its best, the "about" 1/8-scale Embraer Tucano, from Air Champ Models. The Tucano comes completely assembled and painted, needing only engine and radio to fly.**

• Tucano (toucan according to my Webster's) is defined as, "any of a group of brightly colored, fruit-eating birds of tropical America, distinguished by a large, down-curved beak." The feathered toucan, the "tucano" as it is called throughout its Latin American homeland, has for a few years had a new, most interesting larger family member, fathered by "Embraer" (Empresa Brazileira Aeronautica—Brazilian Aeronautical Company). The Embraer Tucano, officially designated the Model EMB-312, was designed primarily to be a military trainer. By the end of 1987, 586 Tucanos were on order by eight different countries, with about half of them already delivered and flying. In addition to Brazil, whose Air Force calls it the T-27 and uses it extensively and where it is in use by its official flight demonstration team, the other countries include Peru, Argentina, Egypt, Iraq, Great Britain, Honduras, and Venezuela. This gives the scale builder a number of color schemes to choose from for an authentic-appearing airplane. However, to save you the trouble of writing, I don't have any on hand! Embraer is trying hard to place the Tucano with the US military but has yet not been successful.

My first experience with the Embraer Tucano, in full size, was in Rio de Janeiro. A truly fantastic city, Rio has something for everybody: great natural beauty ranging from beaches to mountains, all within sight from the same hotel window; unparalleled night life; great dining; and girl watchers can completely wear out a pair of binoculars in one afternoon on Copacabana Beach. Amongst all this, I located a local modeler, learned there was a contest on for that weekend, and managed to get myself invited along.

The contest was at a Brazilian Air Force base a couple of hours outside the city, with the model flying taking place on the flight line. As we drove by some hangers, there was this then-unknown but terrific-looking low-winger sitting there, which I just had to get a closer look. Tricycle gear, ample areas, good moments, deep cowling, long nose able to carry all the necessities—this airplane is just begging to be modeled. It turned out to be a Tucano, and it has been on my list of subjects—as soon as I have some time—ever since.

In real life, the Tucano is powered by a turboprop engine; in some cases a Pratt & Whitney PT6A-25C capable of producing some 750 static horsepower swinging a Hartzell three-blader. The airplane is capable of 280 knots at sea level, can sustain 2g at 20,000 feet, and can climb to 15,000 in five minutes. Tucanos are produced at the rate of four a month and are priced at $1.2 million. Interesting enough, it is available both in flyaway condition or as a kit. No, I wouldn't imagine that it is a fuselage shell and wing cores; it has to be more on the order of an ARF. Just think about writing the instruction manual for that one, and how everyone concerned with the project must feel on test-hop day!

Now, for the Air Champ model Tucano: Air Champ is in Miami, but the Tucano, and the other ready-built airplanes that the company has to offer, are all being manufactured in Brazil, just like the full-sized counterpart. The little ones are shipped up, inspected, repackaged, and available to you with a simple phone call. It is plainly claimed to be semi-scale, with slightly larger-than-life horizontal tail feathers, probably for better stability and/or maneuverability. It is almost 1/8-scale, spans just shy of 56 inches, with a wing area of 560 square inches. With a Picco 45—more about that in a minute—and Futaba Conquest radio equipment, mine weighs in at 6 pounds, 6 ounces. This comes out to a wing loading of 26.22 ounces per square foot, not a critical figure.

Now for the most interesting part: If you were to show this airplane to someone who is completely unfamiliar with it, you would have a hard time convincing him that you did not build and paint it. It is manufactured using normal home building materials and techniques: fiberglass fuselage, symmetrical airfoil foam core wing covered with wood and glass cloth, and sprayed-on poly-

*Continued on page 90*

**A Picco .45 was used in the test model, which required a few easy-to-make changes in the nose section. It has more power and scale-like speeds with the Picco.**


**Keep your nose down and your airspeed up! Good advice for all pilots, from an experienced flyer. Pilot busts add a much-needed touch of realism to our ARF model.**

# ALL ABOUT ARFS

By ART STEINBERG

• A few days ago I was browsing through a batch of mail, and I took a few minutes to examine the summer catalog which had just arrived from one of the world's largest mail-order R/C companies. As I thumbed through the pages, it occurred to me that a great number of ARFs were being advertised. Being of a statistical bent of mind, I decided to calculate exactly what percentage of the advertised R/C flying models were actually ARFs. Of a total of 66 models offered in this catalog, 28 were prefabricated types, which translated into somewhat more than 42 percent. Actually, I really don't know why this should have been surprising, as my informal surveys at various model flying fields have indicated that about 40 percent of R/C models today are composed of prefabs, ARFs, and RTFs. I think we can all agree that a revolutionary new age in our hobby/sport is not only dawning but is rapidly gaining full momentum!

**THE SHARP-45**

Some time ago I tested an unusual new ARF with an unusual name, the Sharp-45. This model is of the Laser type, but with a very sleek and racy appearance. The fuselage and tail surfaces are completely built up of balsa, while the wing is balsa-sheeted foam. The entire airplane is covered with a heat-shrink type of plastic material with a built-in decorative color scheme that is most attractive. Our model came in blue and white flying colors, but the manufacturer also supplies exactly the same design in red and white. Additionally, the model may be had in either a tail dragger or tricycle gear configuration, and the one we chose to review was the more rakish appearing tail dragger style. A beautiful set of wheel pants was included in the kit, but we decided to perform our flight tests without them, in the interest of simplicity. We did use them in subsequent flights and found them to work extremely well.

Assembly was rather simple, as all parts mated closely, especially the well-engineered canopy and engine cowling. The only structural parts which were not supplied were the wheels and the spinner, and these were easily procured. The two wing halves were epoxied together in the usual fashion required when assembling an ARF, and the glue joint was concealed by plastic cover plates which were cemented on the top and bottom of the wing center section. The required four-channel radio equipment was installed, plus an inverted Super Tigre .40 engine. The CG was determined to be in the required location without the addition of any nose or tail weight. According to the manufacturer's specifications, wing span is 59 inches, and weight is 5.2 pounds. I found the wingspan to agree with the specs, and the ready-to-fly weight checked out at 5 pounds, 4 ounces, which is as close as you can get.

As my test pilot, I enlisted the services of Lyle Larson of San Juan Capistrano. Lyle is noted as a highly competitive pylon racer and is a master craftsman when it comes to building and finishing contest models. When he's not racing or practicing for a race, Lyle is usually to be found relaxing with a sport model, spending his time doing low inverted passes. As we discussed the strategy for the initial test flight of the Sharp-45, both Lyle and I had reservations about the placement of the landing gear. We both agreed that the gear should have been mounted further back under the leading edge of the wing for better tracking during takeoff, but otherwise felt that the model had ideal moments and should fly quite well.

The S.T. .40 started quite easily and settled down into a reliable idle. With a slight breeze blowing down the 800-foot paved runway, Lyle taxied out to the center and turned into the wind. As he gradually increased throttle, the plane began to move forward, but just before sufficient speed was attained to cause the tail to come up. We groaned as the Sharp-45 executed a perfect ground loop. After a couple more attempts which yielded the identical result, we knew for certain that the landing gear placement was at fault. On the next try, Lyle started off by punching in full throttle right from the start; up came the tail and she was airborne in a very short distance. Once in the air, the handsome-looking model flew like a real thoroughbred. Lyle was highly pleased with the way it flew: just like a pattern ship, with smooth responses to every command.

This is one of those planes that can make the average R/C hacker-type pilot look like a really accomplished expert. I won't list all the maneuvers the model was made to perform, as it will do anything the pilot is capable of. If you know how to do it, the Sharp-45 will follow your command exactly. Slow flight capabilities are outstanding, as there is no tendency to drop a wing and go into a snap when speed is drastically reduced. Henceforth, landings are slow and easy.

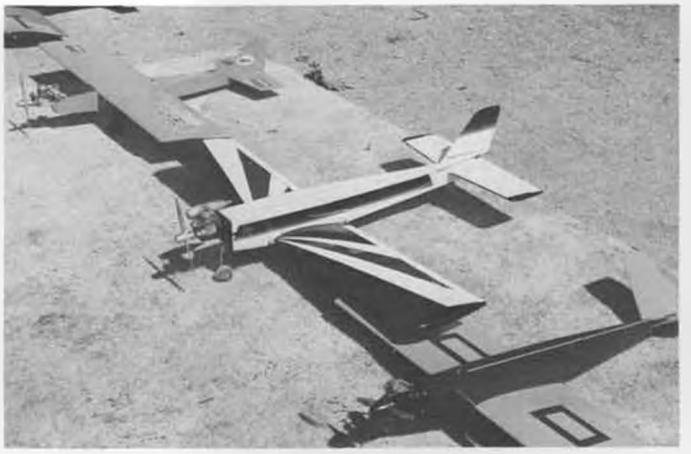
Our one complaint is that of the landing gear placement. So, if you decide to purchase the tail dragger version, be sure to move the gear back under the wing leading edge. The tricycle gear version should cause no such difficulty in ground handling, but my personal preference is for the tail dragger and its cleaner look. Make no mistake, this is not a model intended for a novice, but it can be flown by the average sport pilot who has the ability to fly a typical intermediate model such as the ubiquitous Ugly Stick.

The Sharp-45 is a heck of a bargain, selling for $148, a price which is certainly in line with what it would cost to build a comparable model from a kit. Furthermore, it would take a really skilled builder to come up with a finished airplane which looks as good as this one. The Sharp-45 is available from various retail outlets and mail-order establishments, or directly from the importer, J.C. Model Supplies, P. O. Box 2406, Fullerton, California 92633, (213)690-2019,

Even just sitting on the runway the Sharp-45 conveys the impression of speed. Don't be fooled, it handles beautifully.


On its initial test flight without the handsome wheel pants, the Sharp-45 demonstrates its flashing performance.

Start of a heat with an ARF in the center flanked by two conventional models. A good way for a novice to get into R/C pylon racing.



A few of the models on the ready-line awaiting the next heat. The center model is a Thunder Tiger 20L ARF. Note K&B 3.5 on the model at upper left. It crashed due to flutter.

or Andes Hobbies, 27324 Camino Capistrano, Suite 109, Laguna Niguel, California 92677, (714)582-5203.

**CLUB SCOOTER RACES**

The Palomar R/C Flyers of San Marcos, California, have come up with what must be the easiest pylon event ever conceived. All you have to do to compete is to have a model which conforms to the specifications outlined in the rules. These requirements are so loosely written that dozens of models are eligible, and what makes it interesting to me is that many ARFs are perfect for the event. Believe it or not, if you don't have a model to fly, the club keeps a couple of them handy as loaners. Briefly, the rules require the following minimums:

Wing area, 350 square inches excluding wing tips; thickness, 3/4 inch constant chord; fuselage, 30 inches long; frontal plate area, at least 8 square inches; landing gear, minimum of two struts each with a wheel, no wheel pants; engine, .25 displacement or less, which is currently available for purchase in normal retail or discount outlets; unaltered muffler supplied by engine manufacturer with engine at time of purchase, no after-market mufflers or tuned pipes allowed; servo-operated throttle; fuel is to be supplied at race; no pressurization other than muffler pressure allowed; propeller, must be wood and spinner or safety nut must be used; flight controls, servo-operated control pitch, yaw, and roll; flight pack battery, at least 250 mAh; total weight, minimum of 40 ounces.

Nancy Keele displays plaque which will be awarded to winner of the day's racing events held by the Palomar R/C Fliers.

And there you have it: A set of rules totally custom written to accommodate the average type of .25-size R/C sport model that the average type of R/C sport flier has in his average type of stable right now. Under these rules there really isn't very much a pilot can do to get an edge over his competitors. It really boils down to flying skill, and the ever-present bit of luck. The day I visited the race as a spectator, I did notice one of the entrants had installed a K&B 3.5cc rear exhaust engine on his plane, complete with stock twin exhaust rear muffler. This model displayed a significantly higher airspeed than the other entries, but before it completed the first heat, a severe case of flutter caused it to crash.

I was gratified to see an ARF win an early heat, a Thunder Tiger 20L from Hobby Shack, flown by John Olson. This plane had a tricycle gear and was powered by a Royal .25 engine with stock muffler. John managed to win his heat by exercising his flying skills while piloting a rather docile but reliable airplane.

According to Contest Director Douglas Wilsman, the object of the event is to just have fun, while keeping safety in mind as a foremost consideration. However, competition fever ran high, even though the only prize was a small plaque awarded to the top pilot of the day, and an end-of-season trophy to the holder of the highest overall point score.

The enthusiasm I witnessed among these fliers was so great that I feel every club looking for a change of pace to supplement or even replace the standard fun-fly should give it some serious attention. It allows anyone to enter, even if his only model is of the trainer variety, whether meticulously hand-

*Continued on page 85*

Pilots are all ears at the contest briefing held by CD Douglas Wilsman. Under his direction, contest was run in a professional manner.

John Olson manages a wide grin after winning first heat with his ARF. His plane proved competitive against hand-built models.

ENGINES OF THE WORLD
...by Stu Richmond

This month read about the intrigue behind the delivery of the Krasnoritskij engine to Stu.

# KRASNORUTSKIJ .60 INLINE

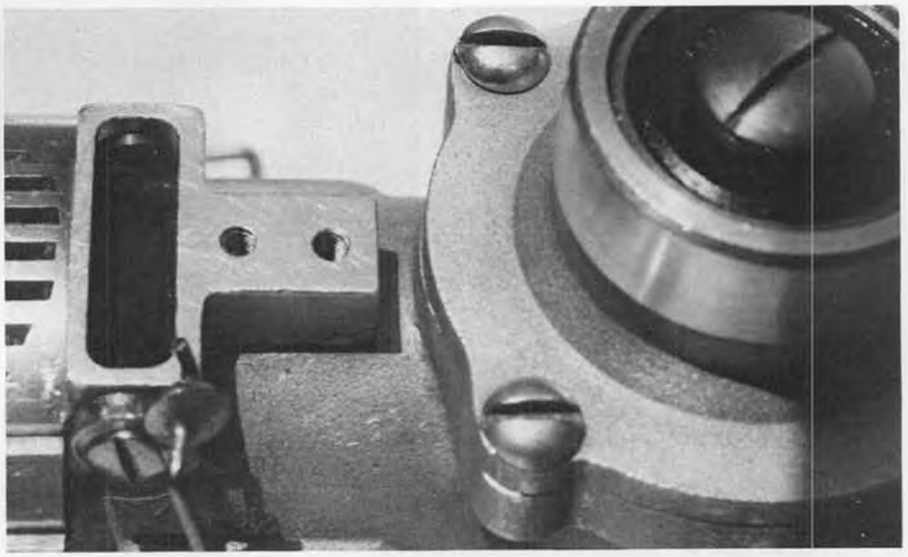
**VITAL STATISTICS:** 6 inches long from the prop drive to the rear of the cylinder head, 2-1/4 inches across the mounting lugs, 2-3/4 inches high. Has a bore and stoke of 24mm and 22mm, weighs 20 ounces. Uses two glow plugs and a 1:1 dual bevel gear transmission.
**UNIQUE FEATURES:** This engine was designed specifically to fit 100 percent within exact scale cowls of a 1/10-scale Soviet Antonov AN-14M twin turboprop scale model. A pair of these engines were in the model when it won the 1974 FAI World Scale Championships for the Russians. Five engines were built in 1973/74 and six were built in 1978/79—this is from the last batch of six. This is one of the rarest and most famous model engines in the world.

• You *MB* readers are the greatest! You make this column possible. If we sound like a spy novel or a James Bond adventure plot this month, please let me assure you the facts *are* picture-clear. I own and now *have* the engine in these pictures. My wife suggests I disguise certain names involved lest problems arise in Eastern Bloc countries for *MB* readers who have helped (or offered help) to get this KK-Zap 10 into my hands.

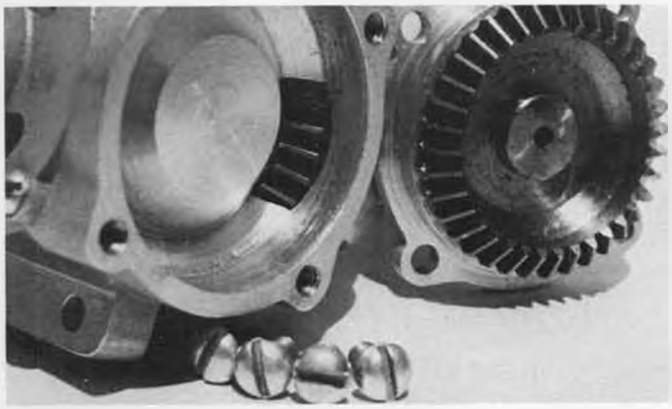
In 1985 I learned there was a second batch of six engines, and I started hot on their trail to hopefully own one. The research file for this month is the most international and extensive of the five years I've been doing this column. And as much as I've dug, part of the story is still deep in mystery; mystery that I still can't fully unravel for you.

In 1972 Russia's Valery Kramerenko and Boris Krasnorutskij teamed up to win second place in the World's Team Race event in Helsinki, Finland. Many of the FAI events are dual participant in nature like today's F3D R/C pylon. (New news: The USA's F3D team for 1989 will be Dave Shadel, Dub Jett, Bruce Richmond, Gary Hover as pilots and Jim Shinohara, Jet and Richmond as callers.) When Kramerenko and Krasnorutskij learned that the 1974 World Scale champs was slated for the USA, they abandoned team racing and opted for a slot on the Soviet Union's scale U-Control team, as it represented a rare opportunity to visit the USA. The F3B scale event was small; only teams from USSR, USA, Poland, and England competed. Canada registered but failed to show. Full teams yielded 12 total entrants. The Soviet's Antonov won by a massive 16 percent over the #2 model from Poland. It's doubtful today that domination

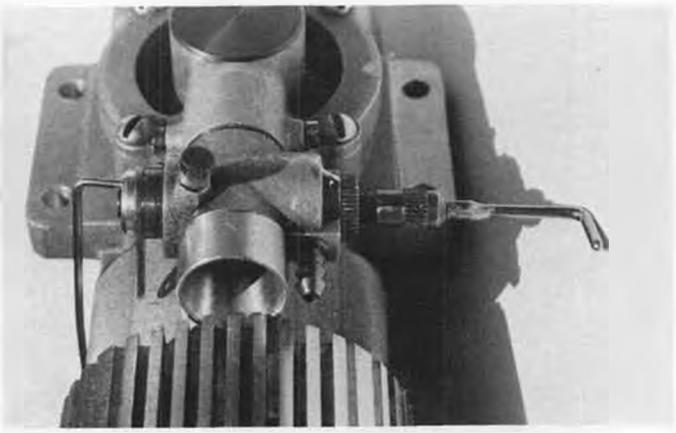
*Continued on page 93*



Big flat head bolt in top right holds transverse shaft into its ball bearing. The bolt rotates with the shaft. One of the designer's student's is known to be making a similar engine from barstock. This engine carries a number 6 hand-scratched on both sides of main casting.



Reciprocating motion is transferred to rotational drive by pair of bevel gears. Power loss in dual gear transmission didn't hamper the design objective: to fit 100% within a full-scale cowl of a model designed to win the world championship.



The throttle barrel has a transfer wire that fits onto the engine's exhaust baffle. As the throttle closes, so does the baffle close to maintain combustion heat at low speeds.

# MODEL DESIGN & TECHNICAL STUFF

By FRANCIS REYNOLDS

• The most frequent question you readers ask in your letters is, "What books do you recommend?" *R/C Model Airplane Design* by A. G. Lennon is good and quite comprehensive. So is *Aerodynamics of Model Aircraft Flight* by Martin Simons at $18.95. I do *not* recommend *Design & Build your own R/C Aircraft* by Kenneth Smith. For the directions I am leading you in this column, on advanced materials, I recommend *Designing and Building Composite R/C Model Aircraft* by Jack Lambie at $16.95. The Lambie, Simons, and the Lennon books are all available from Zenith Aviation Books, P.O. Box 1, Osceola, Wisconsin 54020. Zenith advertises in *Model Builder* and has a big selection. Ask for their catalog. For technical data on airfoils, I use *Theory of Wing Sections* (including a summary of airfoil data) by Abbott and Doenhoff. This book, at $10.95, is also available from Zenith. For aerodynamics, a modern book that I have found very useful is *The Design of the Airplane* by Darrol Stinton, published by Van Nostrand Reinhold at $49.95. You can order this one from most book stores, or in paperback for $39.50 from Sheridan House Inc., 145 Palisade Street, Dobbs Ferry, New York 10522. Good designing requires knowledge, and knowledge is found in books and magazines. Read up.

In my August column I tried to make a funny, which backfired. A little humor can be a dangerous thing. In connection with longitudinal stability I wrote, "If you really must know: the slope of the CM vs CL curve must be negative under all stable flight conditions." The statement is true, but I made it as a joke to illustrate the technical complexity one *can* get into in this game, but need not, in designing good model airplanes. One reader wrote me and wanted to know more about CM vs CL. If others of you are interested in that kind of detail, study Stinton or some other aerodynamics text; it is too technical for this column. But to further the joke, Figure 1 is the curve I referred to.

And in my September column, on cube loading, I made a mistake. (I thought I made another mistake many years ago, but I was mistaken.) William Kuhnle of Richardson, Texas, points out to me that (b+c), which I used in my formula for cube loading to replace wing loading is not independent of aspect ratio as I mistakenly thought it was. To correct the error, Wil suggests using the square root of wing area for our "third dimension." I agree. That will give us a cube loading formula dependent on nothing but the ratio between weight and wing size, which is ideal.

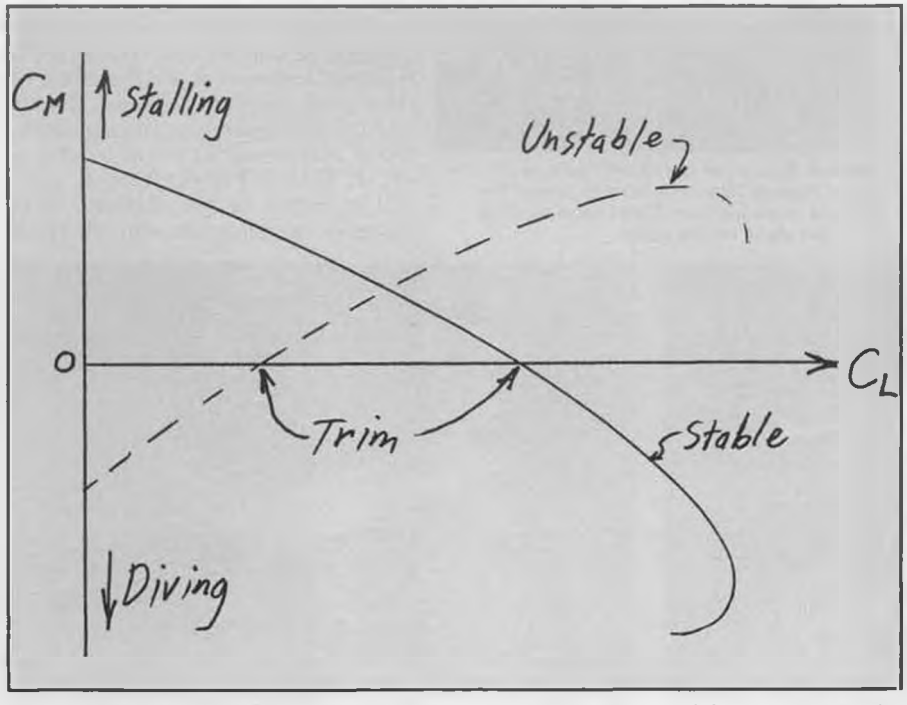



**Fig. 1. Look back to the August column for the germination of this little joke about CM vs CL. Author discovered that a little humor can be as dangerous as a little education!**

The cube loading formula in my September column would have worked well for most model work, but in comparing powered R/C models to sailplanes, for instance, the comparison would have been distraughted by the big difference in aspect ratio between airplanes and gliders. So please forget you ever heard of the CuL formula for cube loading, instead use the formula: WCL=W/S S. Where WCL stands for Wing Cube Loading, S is wing area, and S is the square root of wing area. R/C models will have WCLs ranging from roughly 0.4 to 0.8. Performance factor will be WCL times displacement loading or WCL times twice the power loading, but let's drop the "R" and call it just "PF" to distinguish it from the old RPF. R/C models will have performance factors in the range of five to ten, more or less. You tell me what they are for other types of models. I will convert any CuL data you have already sent me to WLC numbers, and I will convert the September cube-loading/displacement-loading curves to WCL and PF and republish them in a couple months. Sorry about that!

**BYE, BYE BALSA**

You may not need to divest your holdings in Ecuadorian Balsa Ltd. quite yet, but watch it. You don't want to get caught like you did with your buggy whip and cuspidor stocks.

Balsa was perhaps the lightest solid "structural" material we had on this earth, until the plastic foams came along, so it was the natural material for building model airplanes, when *they* came along. But, balsa is getting expensive; it absorbs water, fuel, and oil; it is highly variable in weight and strength; and, most serious, it has a relatively lousy strength-to-weight ratio. I'm not just talking here; I have some engineering data comparing balsa to other woods. Each

*Continued on page 98*

# R/C SOARING

By BILL FORREY

• As a contributing editor to *Model Builder* magazine, I am in a position where I need to be careful to serve its readership faithfully and well. This means keeping a watchful eye on the mail. Your letters to me reflect what I believe are areas of your interest. I hope, therefore, that my answers to your questions, my running your contributions, and/or my monthly topics hit the mark at least some of the time, if not all.

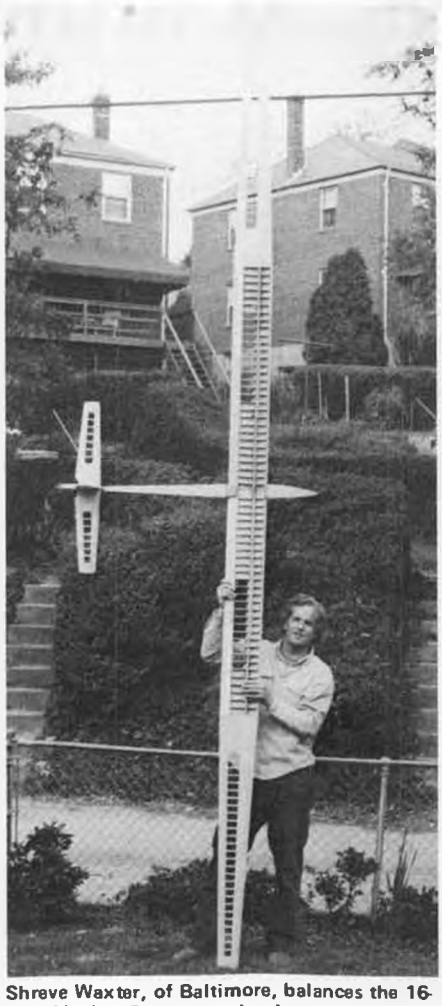
**HOW TO BUILD MODEL GLIDERS**

In my August column I pointed out a few tips for beginners. The subtitles of that column included: What Model to Choose, What Radio to Choose, A Few Building Pitfalls, Before You Fly (preflight checks), The Initial Hand Launches, How to Hi-Start Launch Your Model, Controlling the Model in Flight, and Using Lift to Extend Your flight. It wasn't an exhaustive work; nothing confined to a single column can be. However, it must have come close. Only two letters with questions came back to me.

This month's first letter comes from a 12-year-old from Forest Park, Georgia, whose name is Mathew Bussell. Mathew's letter was really an inquiry for additional information on building model gliders. A subject this large needs to be answered with a book, not merely a letter of reply. So, for Mat's benefit, and for those who thought they would like to hear more on the subject but were reluctant to ask, I have a recommendation:

The name of the book is *Sailplane and Soaring Manual*, written by Al Doig. It is one of the RCM Anthology Books, and it covers the full range of subjects starting from absolutely scratch up through flying your sailplane. A sampling of chapter titles would read something like this: Introduction to Model Soaring, Types of Sailplanes, Selection of Your R/C System, Building the Olympic 650, Tools Needed, Hardware Installation, Launching Equipment, Testing, Trimming, and Launching Your Model, etc. All of these subjects and many more are covered in its 138 pages with lots of photo illustrations. It's an excellent source of information for the beginner, and it could help you save many times its cover price in mistakes or bad decisions.

The *Sailplane and Soaring Manual* sells for $10.00 (third class mail is free, UPS service $1.00). If it sounds like something you'd be interested in, call (800)523-1736 or (800)624-7354 in California, and have your Visa or MC card handy.



**Shreve Waxter, of Baltimore, balances the 16-foot Yankee Soar on a wingtip to put the model in perspective. Some balsa sheeting not yet glued on the wing.**

Letter number two is from Mike Coffey of Salt Lake City, Utah. He writes:

'I have become interested in R/C Soaring after many years of modeling. I was fascinated with your column in the August 1988 *Model Builder* on beginning info for R/C Soaring.

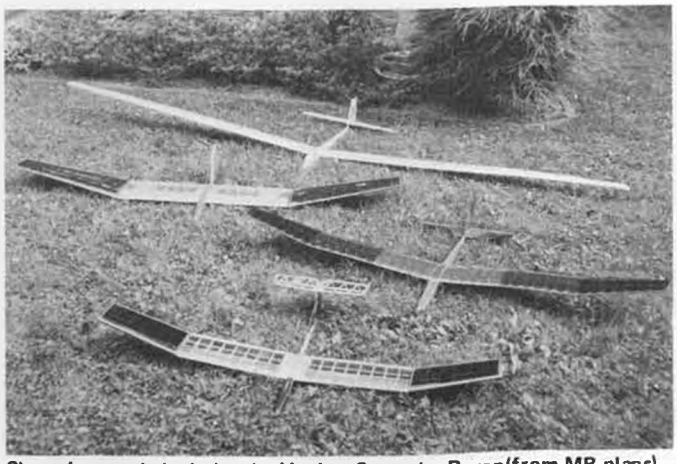
"I am waiting for the arrival of the Gentle Lady, which will be my first glider. I have a question about what to look for in a four-channel radio. Which radios offer the Mode Two? And do you know any clubs in this area?

"Thank you for your time." Thank you, Mike, for the kind words. I went back to reread what was printed in that column to see why there was still a question left in your mind on the radio issue. I found out that what I wrote was a little brief and didn't actually name the kinds of radios I described, sorry! I had in mind radios like the Futaba 4NL Conquest with either (3) standard or (2) micro servos, or like the Airtronics VG-4R Vanguard with (3) standard servos. They both have servo reversing on all four channels to make the initial radio installation easier, and they have rechargeable (Ni-Cd) batteries. There are other four-channel rigs to be found, but these two seem to be the most common. You needn't buy the fancier rigs with mixing functions and dual rates. Beginner's gliders are seldom so sophisticated that these things are needed. In fact, they can spell disaster if a preflight radio check is not made.

There is a club in the greater SLC area. They call themselves the Intermountain Silent Flyers (or was that Soaring Society?). I haven't seen a newsletter out of that bunch for a good six years or more. The only guy I know who you could contact in that area is the National Soaring Society's Doug Dorton. Doug's mailing address is 3058 Bernina Drive, Salt Lake City, Utah 84118. Doug is a well-known flier and the editor of the NSS journal called *Sailplane*. The NSS is the special interest group recognized by the AMA as representing model soaring.

**PROGRESS AT PRINCETON**

Last month in this column I detailed some of the goings on with Michael Selig



**Shreve's armada includes the Yankee Soar, the Raven(from MB plans), an Airtronics Olympic II, and a Richard Odle-designed RO-8.**

**Waxter's Raven from the Model Builder plans service. An excellent flyer with a steep towing ascent.**

and John Donovan at Princeton University wind tunnel experiments. This month, additional info has come in and I'd like to share it with you.

As most of you already know, Selig and Donovan are conducting scores of wind tunnel tests and designing and redesigning new and old airfoils based on the information they are gathering. They are not the first to do wind tunnel experiments, but they are among the most thorough and dedicated who have yet tried. By now they have finished their work in the tunnel and must begin to interpret the data they have gathered.

One of the early tests they finished was a control experiment to verify that the data they were gathering was within acceptable limits. The data came from three other experiments performed at the NASA Langley Low Turbulence Pressure Tunnel in Virginia, Delft in the Netherlands, and the University of Stuttgart (FRG). This comparison was done using the Eppler 387 airfoil data at four different Reynolds Numbers (Rn). In layman's terms, this corrects each model tested (perhaps of different sizes?) and each tunnel's wind velocity and density (probably different) to effectively the same test model with the same amount of wind passing it by so that direct comparisons are possible.

According to Mr. Selig, "Our data appears to be quite good in comparison to the other facilities." He further states:

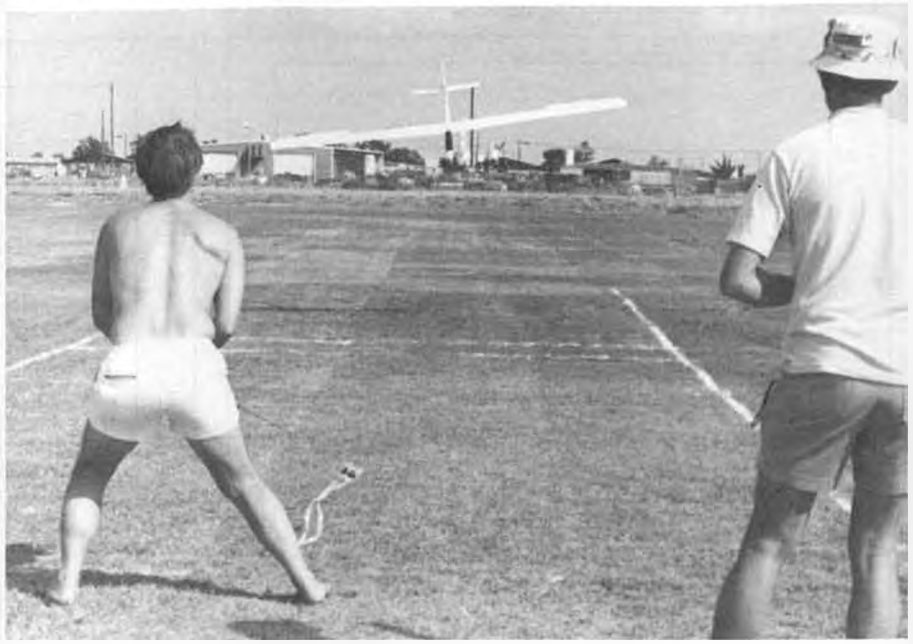
". . .A more complete discussion of the accuracy of our data will be given in Soartech. The end result of this work will be a very reliable data set on a unique collection of airfoils." "As indicated, we have developed several new airfoils. The data has allowed us to better understand the features of good low Reynolds number airfoils. The S3021 compared with the E205 is an example of what can be done; however, we have now improved this (S3021) design. These new airfoils that we are designing lean mostly towards the thermal duration and cross country types of flying.

". . .On a different note, everyone will be able to get copies of the data. The earliest release of the data set will be the Soartech publication and will include data on several popular airfoils. This may be out in two months (probably more). Our method behind the design of low Reynolds number airfoils is still in the preliminary stages, and thus the data on the new airfoils will not be released until we can refine our ideas and submit this work to a referred journal. However, at that time, we plan to put together all of the data from this work in a book which will be easily available. If you have any ideas about how this can be done, please contact us.

"Finally, we want to again thank all of the people who are contributing to this project. Stay tuned." I have included with this report two of the four data comparison tests on the E387, one at a fairly low Rn of 100,000 and another at an Rn of 200,000. This will give you an idea of the difficulty of getting absolutely definitive data on airfoils from any single tunnel with present technology equipment, and with so many different model builders involved.

Megan Dodgson poses with her dad's Pixy 2-meter kit plane. Dodgson Designs jumped on the Eppler 214 early on as the standard airfoil for his Pixy, Camano, and Windsong kits.

Here's a neat way to keep your sailplane on the ground in a strong breeze: two metal stakes and an elastic bungee cord.

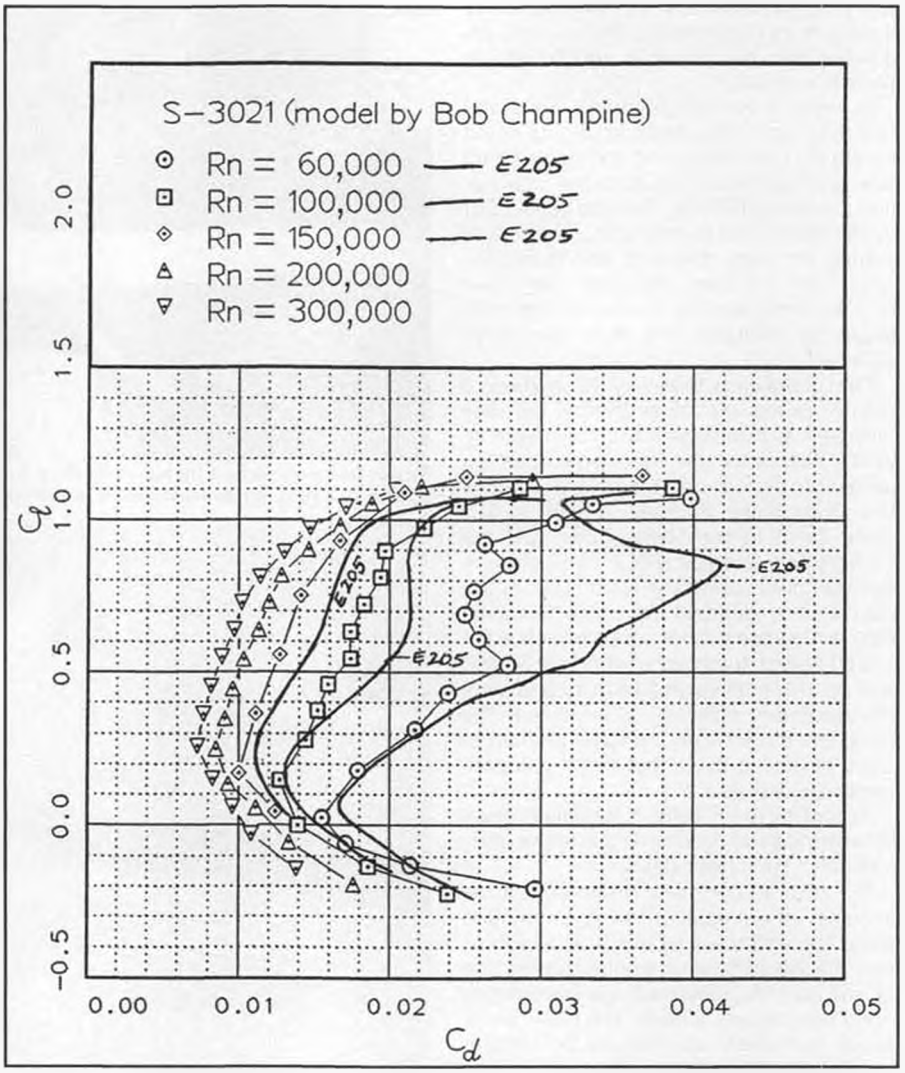


Bob Dodgson shows how to make a Windsong come down in a hurry. Automatic flap and reflexed trailing edge mechanism at work reflexing ailerons and deflecting flaps. See text.

For example, between the Stuttgart and Princeton runs at 100,000 Rn and a coefficient of lift (Cl) = 0.2, there is a a 40 percent discrepancy in the coefficient of drag (Cd); however, Langley and Delft agree very closely.

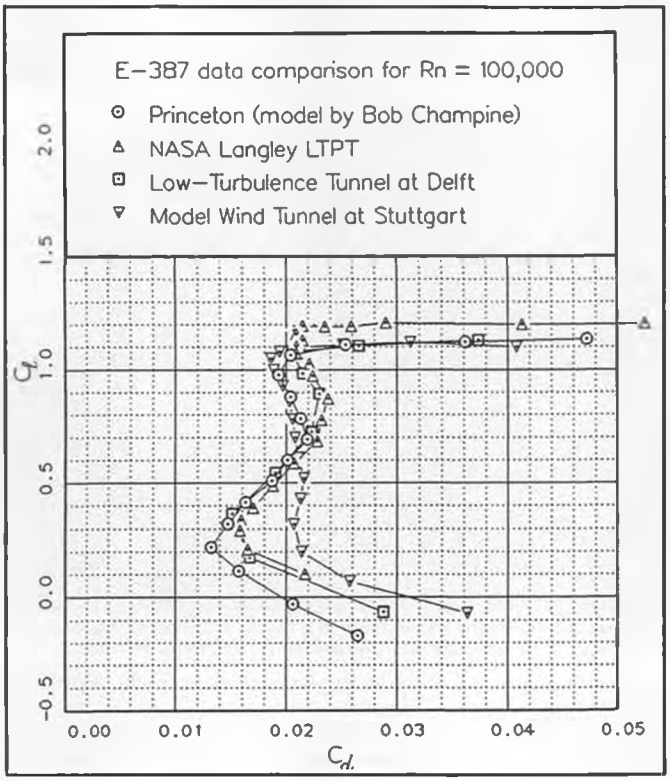
The graph showing the 200,000 Rn run shows three of the four tunnels in very close

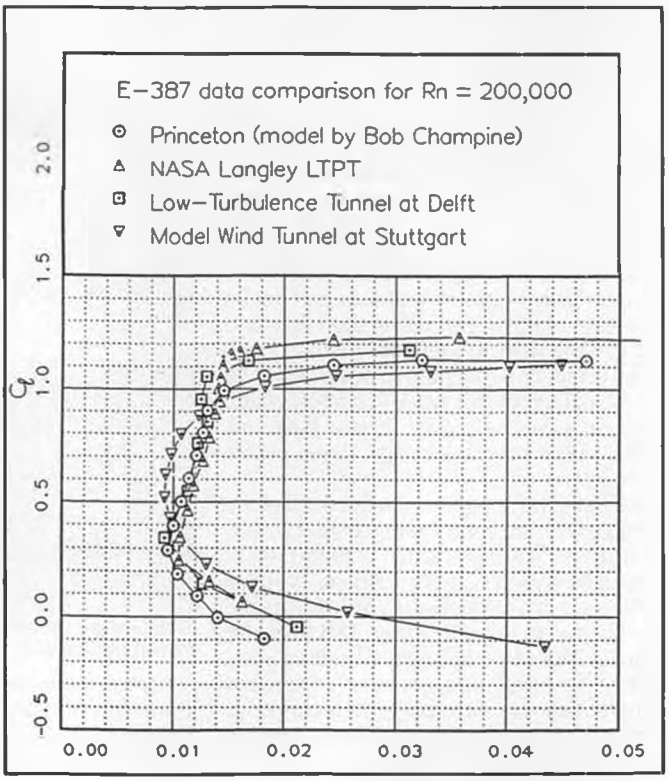
**Not everyone opts for the complexities of camber changine when using the E214. This original design by Tod Allen only has spoilers and ailerons. He says it flies great!**




agreement in mid-performance envelope, but one is overly optimistic (Stuttgart). None of the four agree on the top-end performance (high Cl) of the E387. The spread is 14 percent at Cd = 0.02 between NASA Langley and Stuttgart. Only two of the four can agree on the bottom end performance (low Cl) of the E387.

From this layman's point of view, wind tunnel data from different wind tunnels compared against each other appears to be somewhat erratic. Given at least four tunnels, it may only prove that your tunnel is no better or worse than anyone else's. However, comparing the data on different models from the *same* wind tunnel should prove to be very valuable in determining the comparative strengths and weaknesses of different airfoil sections. As I see it, the only variables will be the atmospheric conditions (correctable) and the model ac-



curacy (not correctable).

As a little foretaste of things to come, I've included the comparison done by Selig and Donovan between the Eppler 205 (a very popular section) and the S3021, which was Selig's "improved E205" airfoil. I drew the E205 over the S3021 graph with a thick ballpoint pen.

The most dramatic improvement is seen at 60,000 Rn and a Cl of 0.8 where the S3021 exhibits 40 percent less drag. Good news for R/C hand launch competitors! Similarly, at 100,000 Rn and a Cl of 0.7, there is a 16-percent decrease in drag. Good news for big, light thermal fliers! Then at 150,000 Rn and the same Cl of 0.7, we see a 14-percent decrease in drag. Good news for competition R/C thermal gliders! The bottom line is a theoretical *and* a real-life proven track record which says that the S3021 is better than the E205. Better lift to drag ratios means better ground covering ability, better wind penetration, and better climb rates. . .all else being equal, of course! Makes you wonder how much better the new Selig section is, which is an "improved S3021!" More shall be revealed this winter. And for those who need it all, I suggest you contact Herk Stokely at Soartech for the upcoming "popular" airfoil report. His address is: 1504 Horseshoe Cir., Virginia Beach, Virginia 23451. Send a large, self-addressed, stamped envelope to receive a reply. Seven Soartechs have been published so far ranging in size from 90 pages to about 200 pages. The list you will receive in return will indicate which papers will be seen in which back issues. All back issues will be continuously available. Prices for the books vary with size and distance to destination.

By the way, if all those graphs are just a bunch of chicken scratch to you, another back issue will be of interest. My April 1987 column was entirely devoted to interpreting "profile polars" as they are called. How much, you ask? Call *Model Builder* or look up the going rate for yourself in the "Oldies (But Still Goodies)" house ad in this or recent issues.

**R/C SOARING IS ALIVE AND WELL IN BALTIMORE!**

That's the greeting I received from Shreve Waxter of 632 Colorado Ave., Baltimore, Maryland. He sends the following letter, including (I believe) an appeal to camaraderie.

"R/C Soaring is alive and well in Baltimore! Enclosed please find pix of my gliders. I just finished the *MB* Raven (built from *Model Builder* plans, of course). It is 110 inches in wingspan, features rudder, elevator, and a Kraft Gold Spectrum radio. She flies well with nice, steep hi-start launches; really sensitive elevator as you might imagine. I built it as a one-piece wing to save weight, so transporting it takes some consideration.

"In the group shot, the monster in the back is a "Yankee Soar" built from *MAN* plans. It has a 16-foot span, lots of balsa, and fiberglass in wing, rudder, full flying stab, ailerons, and blade-type spoilers. Also, see the shot of this plane under construction. Plenty of ribs, all sheeted surfaces.

"The last two planes in the group shot I'm sure you'll recognize. Oly II with Tower Hobbies radio and Dynaflite (Mark's Models) RO-8 with Cannon Super Micro radio.

"I am presently building the little Gnome HLG because of your enthusiasm over this type of glider. They build fast and provide plenty of fun. Next in line is the Klingberg Wing, and after that the Airtronics Gran Esprit (bought one of the last kits about four years ago).

"I presently fly in an industrial park north of Baltimore, but sites around here are scarce. No flying shots because I usually fly alone. I know of no clubs in this area, but I have plenty of fun anyway!

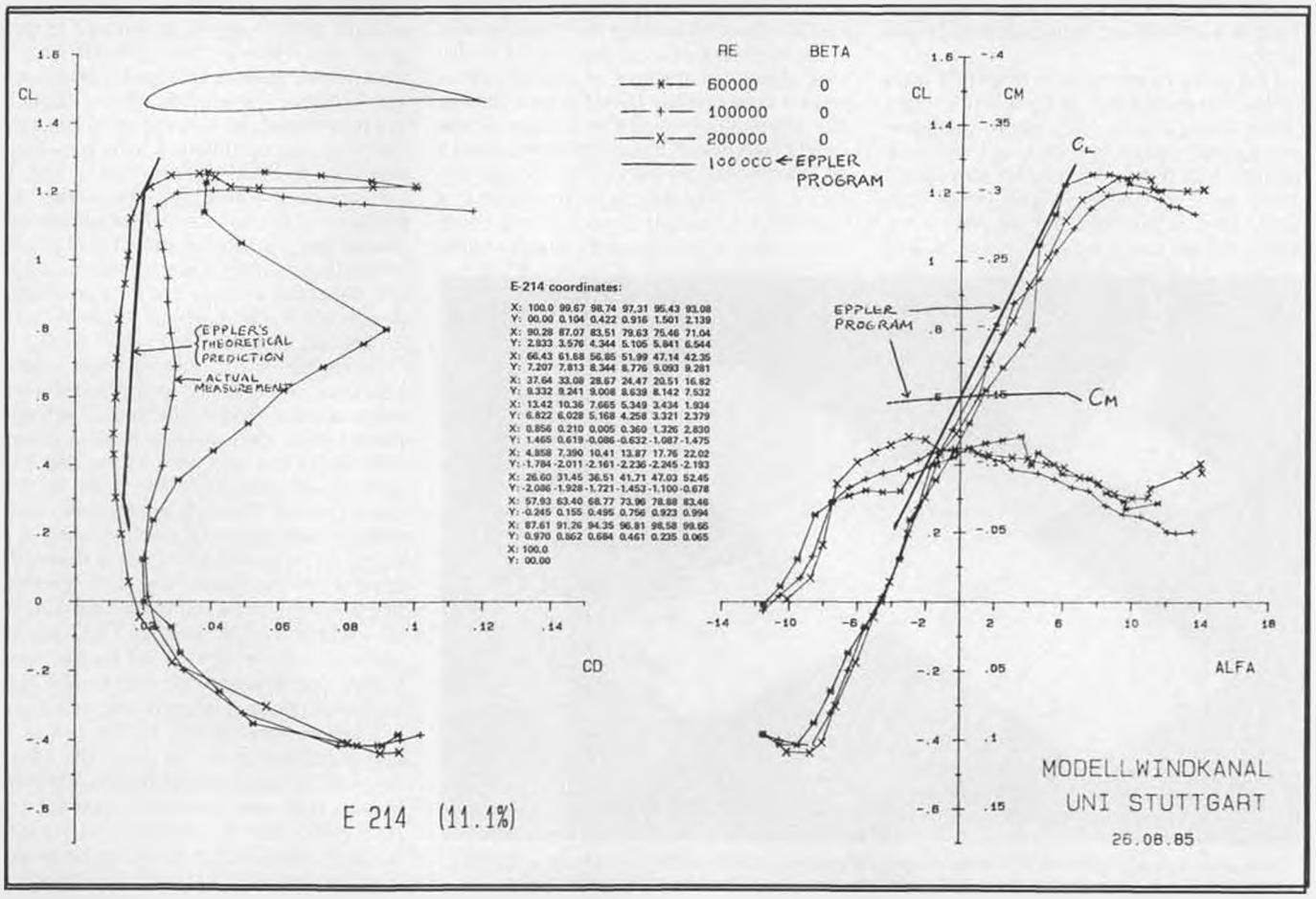
"Really enjoy your column. Feel free to print any of these photos, if you wish, to get some East Coast coverage.

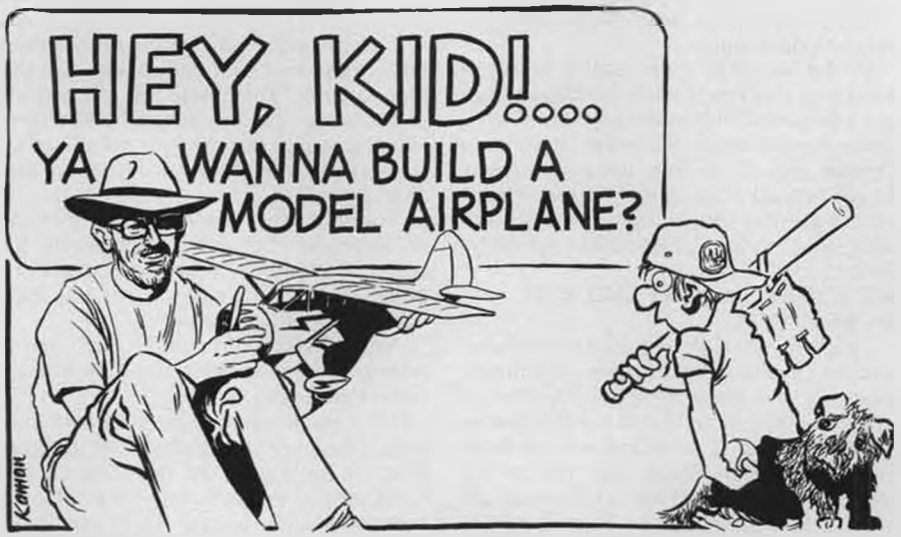
"P.S. Lawn in photos uncut because I just spent the morning flying. . .first things first!" Thank you for the much appreciated East Coast coverage, Shreve. It is great to see a scratchbuilder among the many *Model Builder* readers out there. There are rewards to be had by such ventures which far exceed the kit kingdom and all its sameness.

The *MB* Raven, for those who are curious, was a design published back in January of 1982. It is Plan No. 1821 and its price is $10.00 plus $2.00 shipping and handling, plus 60 cents if you use a credit card, plus 60 cents sales tax if you are a California resident; got that? You also receive with each plan a reprint of the original construction article.

For Shreve and anyone else in the Maryland area, there is a major club there called CASA (Capitol Area Soaring Association?). If I had one of their newsletters (hint,

*Continued on page 101*






**By BILL WARNER** **Illustrations by JIM KAMAN**

## PART FOURTEEN

• Well, gang, it's been a long way from the Sleek Streek to where we are today! During the past thirteen episodes we have covered a few ways to build and fly basic models. I'd like to conclude this beginner's series with an introduction to what I regard the ultimate in modeling; namely, free flight scale. These models look like real airplanes. There are even contests for scale models where the model is judged to see how closely it resembles its full-size counterpart. Judges check to see if things are made to right scaled-down size, if there are the right number of ribs in the wing, if the colors and markings are correct, and what kind of a job you did making it look as real as possible.

One of the problems with free flight scale is that the model has to fly when you get done with judging. Very often, modelers put so much work into making them look realistic that they are too heavy to fly well! Then there are the guys who do as little fancy stuff as possible and are only interested in how long they stay up. I think that beginners should try for the ones that fly well to start with and work their way towards the highly complicated ones later. Problem is, when a kid sees a beautiful picture on a kit box in a store, he or she just *has* to build that one! Last week, one of my students brought in a rubber-powered Taylorcraft model he had built from a kit by a big manufacturer. It was so heavy, due to the lousy construction the manufacturer had designed and the super-heavy balsa (I think it was either balsa or oak) that it did not stand a snowball's chance. It took a hunk of modeling clay the size of a golf ball on the nose to balance the heavy tail end and get the CG about 30 percent of chord (forward of the midpoint of the wing, that is). It also took about ten degrees of downthrust to keep it from stalling under power. Believe me, it took plenty of rubber to move all that weight fast enough through the air to keep it up, too! About all we could manage was about a five-second flight on a model that, if built properly and out of good wood, could have turned a minute easily. It was not the fault of the kid who built it. He had done a very nice job.

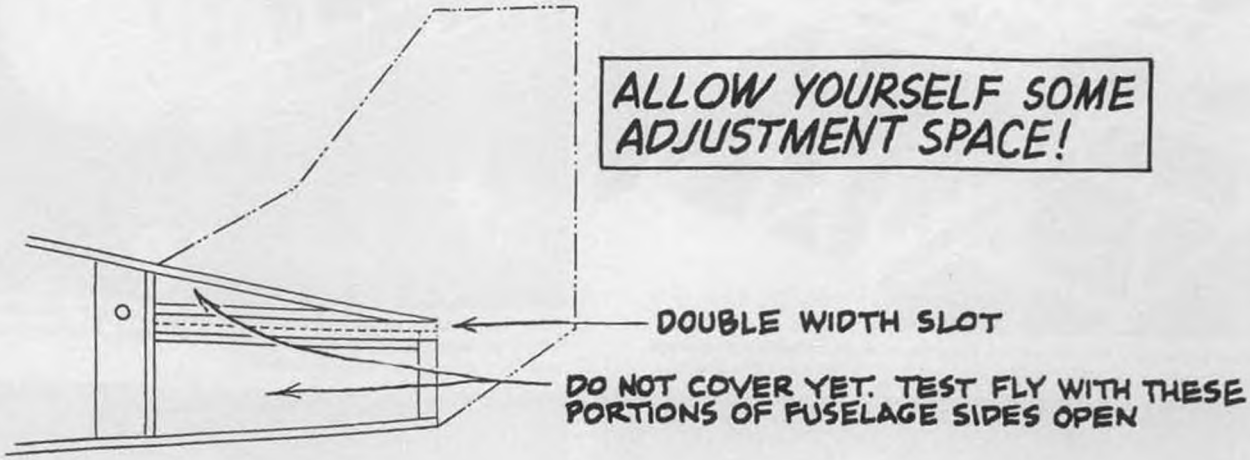
So, what is the moral of the story? Choose what you are going to build carefully. As you probably already have Peck's catalog, I'd like to recommend the following models in order of the easiest to the most difficult: easiest is the Lacey M-10, then Nesmith Cougar, followed by the Clipped-Wing Cub, and finally the Andreasson BA4-B biplane. Guess what? The easiest ones fly best! The Lacey has probably won more contest places both indoors and outdoors than any other scale model in history. That's because its designed like a model airplane! The Nesmith Cougar is a great design, too, and I once timed one on an over-20-minute flight in a thermal! The Clipped Wing Cub is more delicate than the two we just mentioned, and makes a lovely little plane that will fly very nicely, especially indoors in a gym. The Andreasson biplane is a cutie, and, though heavier, it is a realistic and stable flyer, even though it will have to strain to make 45-second flights.

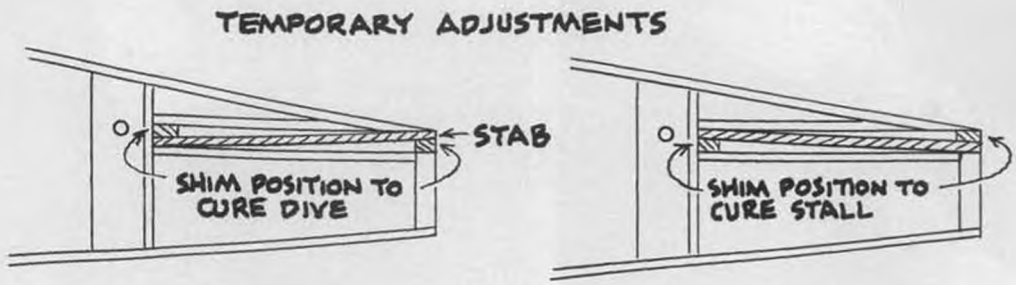
What makes for a good scale model? Hard to say. Most guys make 'em because they like the looks of the particular model. Others choose a certain one because it's what is winning all the contests. The Lacey is a good choice because it fits into the "Peanut" category of competition; that is, it has a wing span of under 13 inches. The Lacey has a lot of wing area to carry its weight. We can say it has a favorable "wing loading" as compared to, say, a modern jet airplane. It is also a "slab-sider," which means that is has flat sides and is easy to build like a box without a lot of fancy structure inside. The stab and rudder on the original plane were large enough to do a good job, whereas many models have to have at least the stab enlarged to get a good, stable flight. The landing gear is about as uncomplicated as landing gear gets, and the wing has no dihedral, which makes it very easy to build. Besides that, it just sits on top of the fuselage! Joe Lacey, the designer of the full-size homebuilt aircraft, should get a medal for this marvel of simplicity. It may not be as gorgeous as a Stinson Reliant or a Waco, but for a good solid design of a flying machine, it rates a "ten."

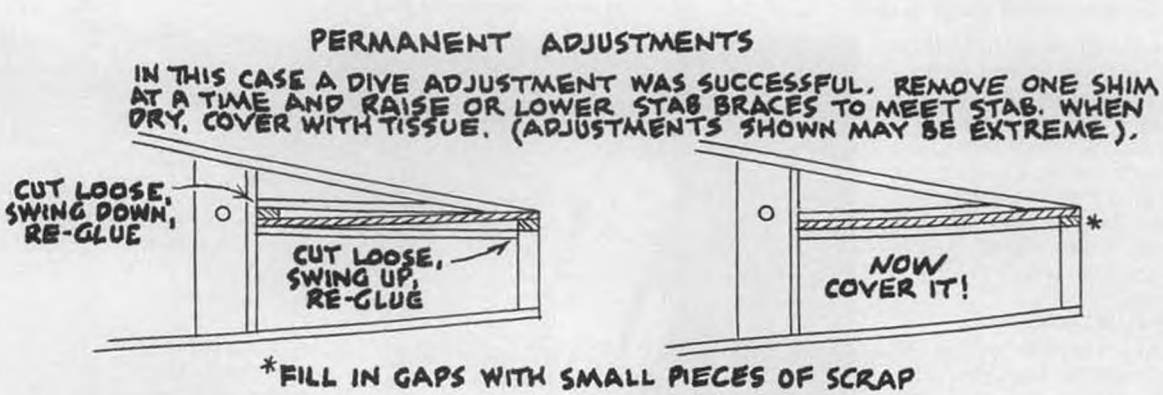
### OPENING THE KIT

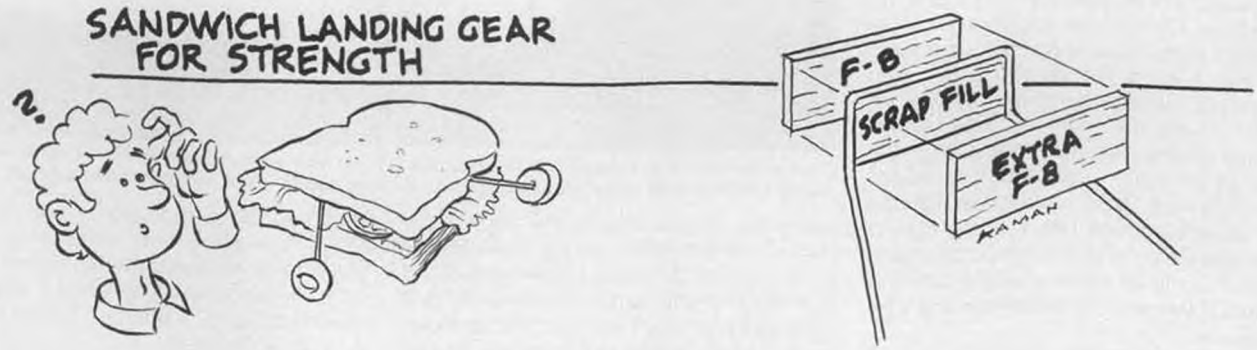
Be careful not to lose the thin strip of basswood needed for the laminated windshield frames. Find it right away and tape it to the box so you won't lose it. Next, decide whether or not you want to use the 1/20-inch square sticks included in the kit. You can substitute 1/16-inch square if you want, making sure they have enough stiffness to do the job of holding the ends of the model apart when the motor is wound tight! Notice that there are some longer sticks in the kit which are a little heavier. These are the 1/16-inch square sticks used for the wing. Even if you decide to go with the kit 1/20-inch stick design, I strongly urge you to use at least one other length of 1/16-inch as an additional spar under the wing. The advantages of 1/16-inch are better-looking (they bow-in less) and stronger (assuming you have tested them for strength and not used "punky" wood, which may even be weaker than the smaller, 1/20-inch!). The disadvan-

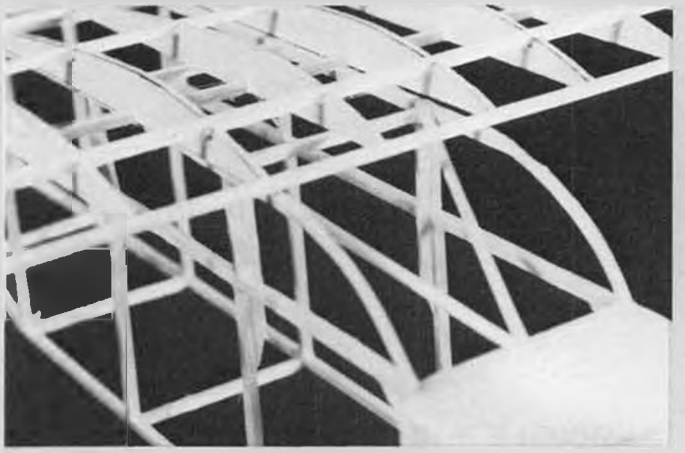
**The Lacey, a Peanut version of a popular, good-flying homebuilt model. Built from a kit, this month's column takes us step-by-step through the construction of this delightful model.**


ALLOW YOURSELF SOME ADJUSTMENT SPACE!
DOUBLE WIDTH SLOT
DO NOT COVER YET. TEST FLY WITH THESE PORTIONS OF FUSELAGE SIDES OPEN

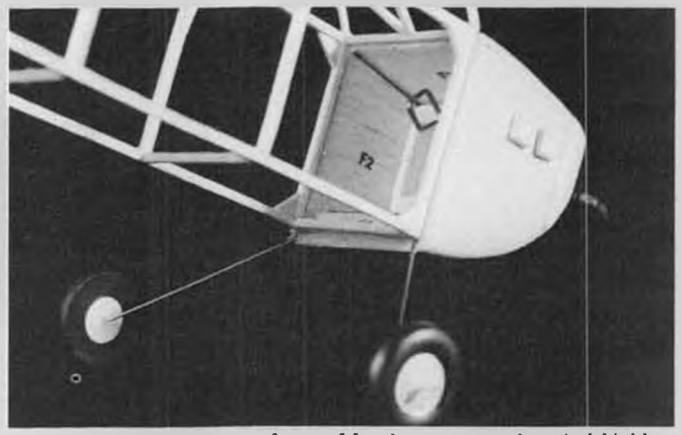

TEMPORARY ADJUSTMENTS
STAB
SHIM POSITION TO CURE DIVE
SHIM POSITION TO CURE STALL


PERMANENT ADJUSTMENTS
IN THIS CASE A DIVE ADJUSTMENT WAS SUCCESSFUL. REMOVE ONE SHIM AT A TIME AND RAISE OR LOWER STAB BRACES TO MEET STAB. WHEN DRY, COVER WITH TISSUE. (ADJUSTMENTS SHOWN MAY BE EXTREME).
CUT LOOSE, SWING DOWN, RE-GLUE
CUT LOOSE, SWING UP, RE-GLUE
NOW COVER IT!
*FILL IN GAPS WITH SMALL PIECES OF SCRAP

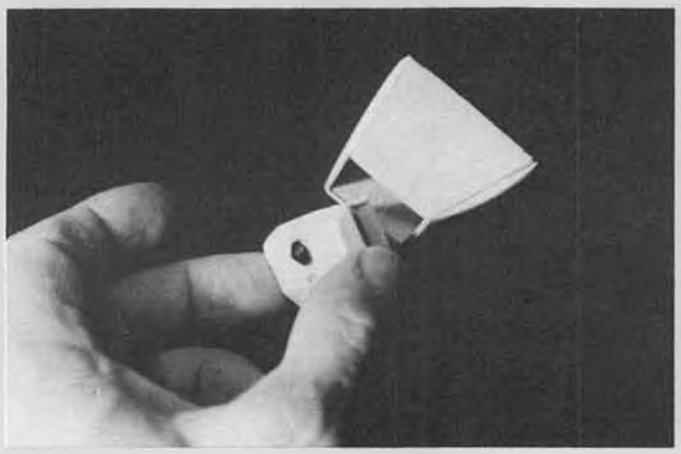

SANDWICH LANDING GEAR FOR STRENGTH
2.
F-8
SCRAP FILL
EXTRA F-8
KAMAN



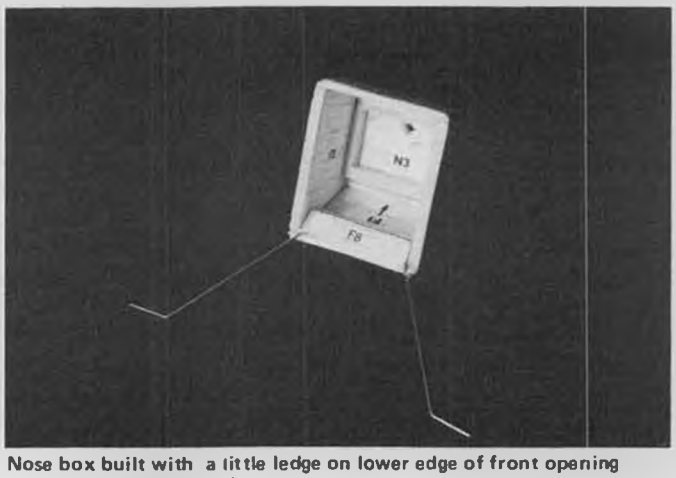
Wing sits nicely on top of the fuselage making attachment a cinch. Note position of rounded sticks forming Vee in windshield area.



Nose box attaches easily to front of fuselage, even at the windshield where it overhangs a bit at the bottom and sides. Numbers on nose parts will not show; they're inside!



Snug fit of nose block is very important. Keep working on it until it removes easily, but does not fall out on its own.



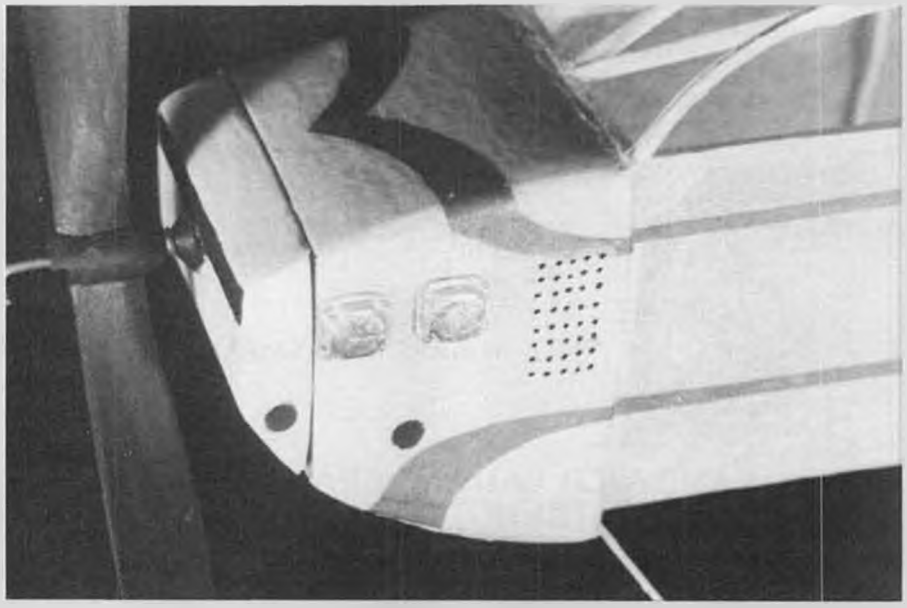

Nose box built with a little ledge on lower edge of front opening to accommodate nose plug.

tage is that they will add weight behind the wing in the tail area, which will then require nose weight to balance it out. If you add an extra gram in the tail department, you will have to add two more in the nose (shorter) to balance out that extra gram, which gives you *three*, not one, extra grams of weight penalty for that extra strength. Still, until you are in the "expert" builder stage, I'd advise you to go with 1/16-inch on the fuselage as I did.

**BUILDING THE FUSELAGE**

Follow the same procedure as the FAC Moth. When you have the two sides of the fuselage done, "box" your fuselage over the plan top view with the long, flat area where the wing will go pinned to the plan. This means you will be building the fuselage upside down. On any plan you always want to find the longest flat area on the fuselage and put that section flat on the plan when boxing-up. Make sure you use building triangles along the sides to keep things square. Notice that the front end of the fuselage is made separately and added later. This nose "box" has the wire landing gear assembly glued into it at the correct angle and the nose block (removable) fitted into it. It could be added after the model is covered if you wish to make covering a bit easier.

Before you start the fuselage sides, it might help to leave the part where the horizontal stabilizer goes (the slot shown with a lot of little 45-degree lines in it) about double the width shown. This will leave



Completed nose box attached to fuselage. Balsa front end is tissue-covered for strength and to match rest of model color. Vent "dots" are done on doped tissue and added like a decal.

you some room to change the angle of the stab if needed when doing flight trim. I prefer to leave the tissue off that area at the rear of the model until the stab is set just right and glued in. Then I cut the sticks on each side of the stab slot loose and reglue them snug against the stab. Then you can cover the rest of the fuselage and have a neat job!

The tailwheel wire can have a round loop bent into the end around a nail or with round-nose pliers and some scrap balsa glued in to represent the tail wheel itself. On a couple of the Laceys I have made, they needed this area "leaded in" for tail weight to balance the nose!

The toughest part of the fuselage is the windshield frames, which are laminated from two thicknesses of basswood strip. You set them aside earlier so as not to lose them,

remember? Make a form to bend the strips around with the same curve as the side view of the windshield. You can use tracing paper to get the curve, glue it to a sheet if 1/8-inch scrap balsa or cardboard, and cut it out. It should be the *inside* curve to allow for the thickness of your part which you are forming around the outside of it.

Rub some soap or wax on the form where it contacts the wood you are bending to keep it from sticking. The bass strip should be cut into four equal lengths; two for each side. Normally, wood to be laminated is soaked in ammonia to make it more supple, but you will not need to do this unless you want the practice. Using white glue, coat one side of a strip and join another to it to make a "double-thick," two-part stick. While the glue is still wet, tape one end to your bending form with Scotch or electrician's vinyl tape. Apply a little end pull as you bend it around your form and tape the other end down. I usually use my thumb to keep the part pushed tightly against the form at the point where it contacts the form, using a sliding motion from one end to the other to prevent the strip from buckling upward as it bends. When it is dry, trim to the size shown on the plan and glue in place on each side as you build it flat on the plan.

In the windshield area there are two little rounded sticks that form a "vee," the point of which is right in the center of the fuselage where the front end "box" glues on. Look at the top view and you will see what I mean. The designer had a hard time showing you how to do this area so you would not goof up and glue these sticks flat with the sides. I have seen many kids do just that, so be careful.

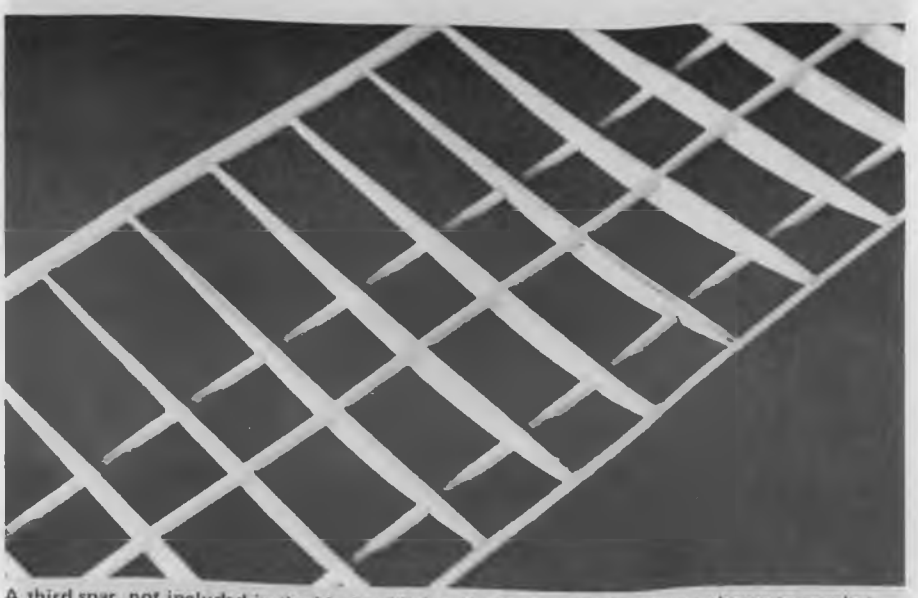
Another place it is easy to mess up is where it looks like the vertical fin and rudder assembly is made right on the side when you build it flat. It isn't. It is a separate part that gets covered before it gets glued on right in the center of the finished fuselage.

**TO HINGE OR NOT TO HINGE**

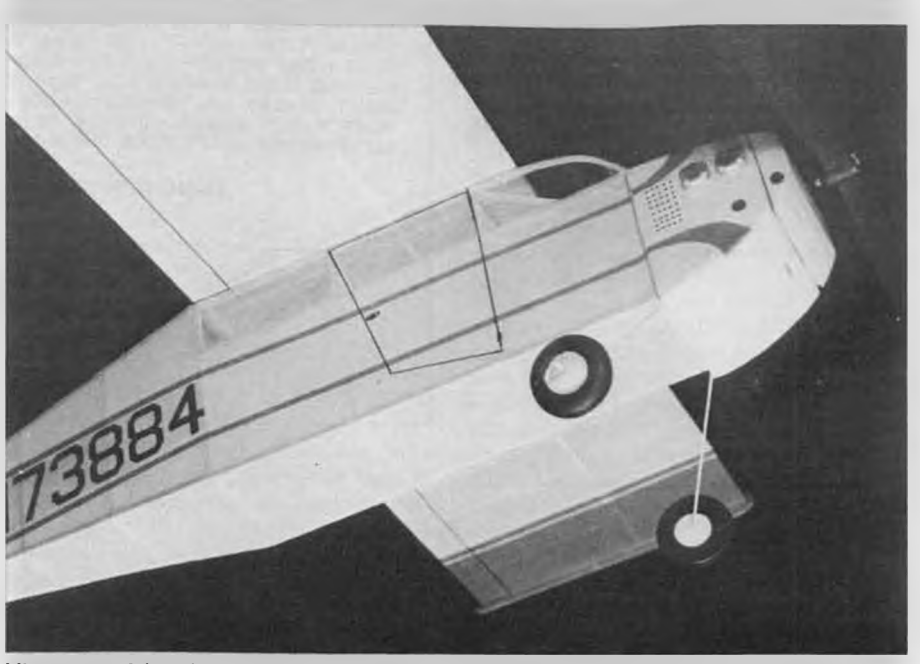
On full-sized aircraft, the rudder is movable, so are the ailerons and the elevator. Trying to be "scale," many kids make those parts separate or cut them loose and then try to make them movable by attaching them with floppy tape, tissue paper, or bendable wire, which always bends when you just slightly bump it. All of these are poor ways to do the job, as any movement on these surfaces which you do not plan and which does not stay where you put it will get you into trouble when it is flying time. You will never get two flights alike and your model will be constantly out of trim. If you must make movable surfaces, use a metal "hinge" that does not bend easily. Thin bits of aluminum will work, but you must make them at least 1/8 inch wide so they will offer some resistance to bending. I usually also use a drop of glue every now and then to keep the surface from moving. It does not take much movement to make a world of difference. I often use music wire, which is almost impossible to bend and springs back to its original position if bumped.

**THE WING**

This is a piece of cake! No dihedral to put in, all ribs the same size; what more could anyone ask for? The Lacey is one of the few models that you can build with no dihedral and get away with it. The deep, flat-sided fuselage seems to help stabilize the flight. It's not quite as easy to adjust, but its record of contest wins when flown by junior modelers proves that it is not all that difficult!



A third spar, not included in the kit, is added to the bottom of the wing as shown to combat tendency of wing to bow downward when covered and doped.


View under right side shows door and aileron markings done in India ink. They can also be added with thin strips of black tissue or chart tape.

The bracing sticks which go from wingtip to wingtip on top of the wing are called spars, and there is likely to be a problem with them. Wings tend to bend *away* from spars on top or bottom if there are no spars on the opposite side of the wing to oppose them. It has to do with the pulling-up power of the covering. There is an Aeronca "K" floatplane kit that has been on the market for years which is notorious for having its wingtips bow upward. Guess where the two spars are? You guessed it; both on the bottom. Guess what happens to the Lacey wing with both spars on top? That's right; the tips bend downward into what is known as "anhedral." You could fight this by pre-shrinking your tissue and doping it while it's still on the shrinking frame. I prefer to *oppose* the top spars with an extra one *under* the wing splitting the space between the top spar positions. All it takes is filing in an extra series of notches with your notcher while you have the ribs stacked doing the top notches.

**TIP PLATES**

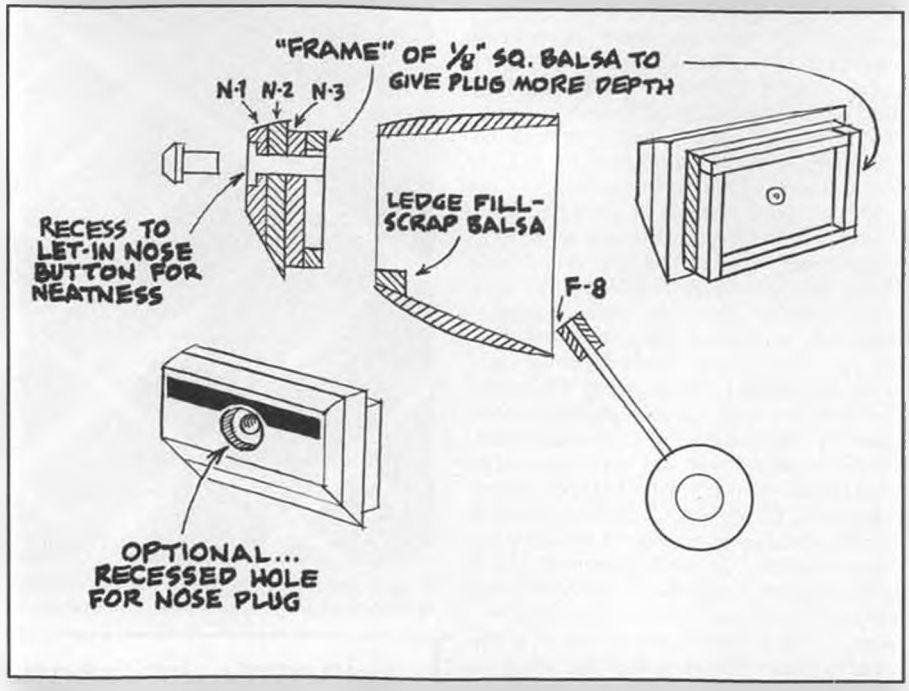
Another feature of the Lacey is the "tip plates," which glue to the ends of the wings after the wings are covered and the red tissue trim has been added. They are there for a very good reason, namely to prevent the high pressure present under a wing flying at an angle of attack while merrily getting lift from sneaking around the wingtip toward the low pressure area on top of the wing. When this air does get around the wingtip, the front-to-back airflow shoves it rearward at an angle, setting up a whirlpool or "vortex" effect which gives you a lot of drag. When you put tip plates on the ends of the wing, you help stop this from causing such a big problem, and it actually gives you the effect of having a bigger wing than you really have!

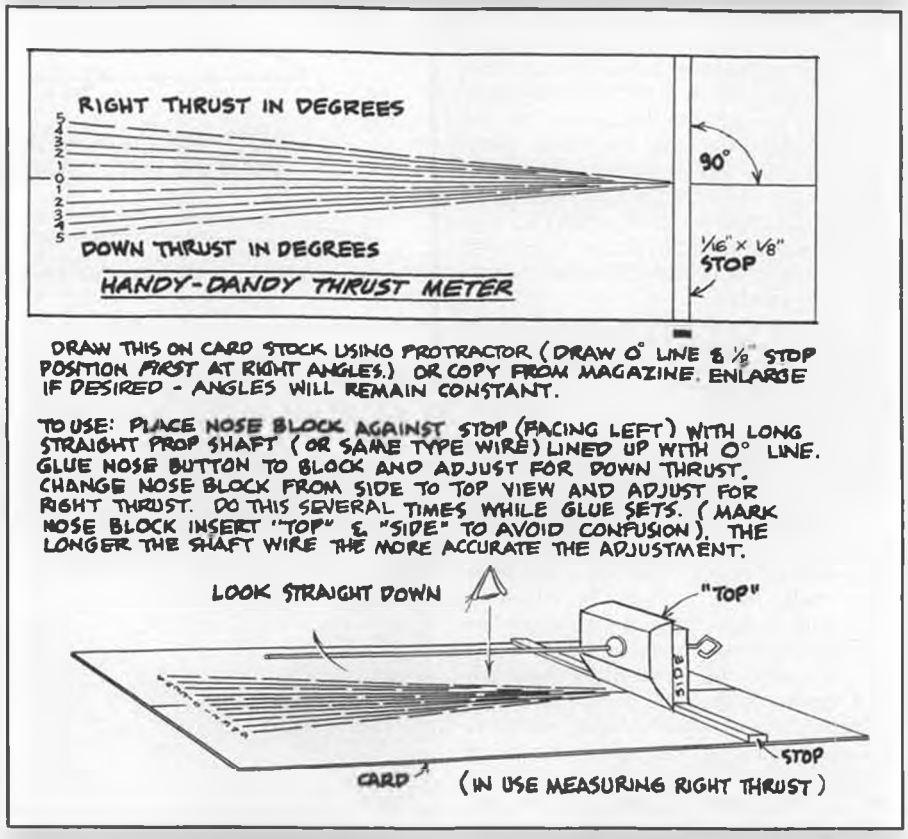
**THE NOSE ASSEMBLY**

The nose "box," built of four pieces of balsa, is fairly simple to put together, but there are some tricks. One trick is to make a little "ledge" along the lower edge of the opening on the inside, filing it flat with a nail file sanding board after it's dry. This gives the plug-in nose block something better to hold on to than the sharp up-sloping edge which would wear down after a few nose-plug removals and reinsertions.

When you make the nose block that plugs into the box, the "plug" which slips in could be made a little longer to keep it from falling out if you have to add any thrust adjustment shims later on. I use a "frame" of 1/8-inch square balsa added on the rear of the plug. This helps hold any modeling clay ballast I may have to add to the nose for balance later, too. In any case, make sure that the nose block is *snug* so that it does not fall out and that it is removable for winding without too much strain. Glue a thickness of paper on a side, sand some off, or whatever, but pay attention to this fit so life will be easier on the flying field. A nose block that won't keep your thrust angle correct in the air or that keeps falling out when the power runs down is no fun.

The landing gear is plugged and glued into the nose box with a rearward rake which makes it almost impossible to rip out. If you want to really make sure it is solid, sandwich it before you glue it in by "filling" the center portion with balsa the same thickness as the wire and then adding a piece of 1/32-inch balsa on each side.




Getting the nose button glued in at the correct downthrust and sidethrust angles shown on the plan can be more easily done if you draw the needed angles on a background and hold the nose block with the newly glued-but-not-yet-dry nose button in its hole in front of it. Use the prop shaft in the nose button to help line it up in each direction (downthrust and right thrust) before it dries. By the way, a nice touch is to "let-in" the nose button a little by making a shallow hole with a sharpened piece of aluminum tubing or the end of a pencil with the eraser removed and picking out the balsa with the point of your modeling knife so the nose button sets with its nose just even with the front of the nose block.

**COVERING**

You can cover the fuselage and the nose box separately, sticking on the tissue with thinned out (60-40) white glue. If you use the supplied 1/20-inch balsa, maybe you would like to use pre-shrunk tissue on the fuselage as well as on the tail parts. Giving the tissue a coat of 50/50 nitrate dope (half thinner) while still on the shrinking frame is

a good idea. Some guys even draw on their striping and lettering while the tissue is on the frame, as it's easier to work with using the part of the plan with the original art work underneath so it shows through. If you use India ink for any of this, spray a coat of clear dope or lacquer, like Testor's Dull-Cote, over it to make sure moisture does not ever make it run.

If you are going first-class, you may want to use Japanese tissue instead of the domestic tissue in the kit to cover with. It gives a nicer and lighter job. The Peck domestic black tissue, however, is superior to black Japanese tissue if you cut out your letters and door/aileron striping from it because it does not fade.

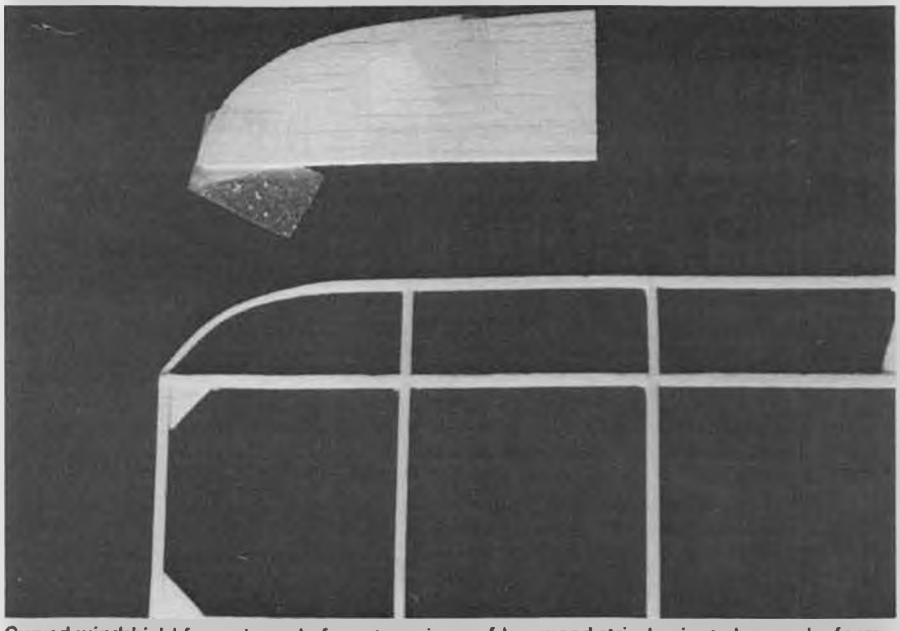
Doing the red trim is not too difficult, just dope through it with thinned nitrate dope. Cutting the curved parts of the trim is easy if you draw the stripe on tracing paper. Tape it down to cardboard with a couple of layers of red tissue under it (grain the long ways) and cut through the lot carefully with a *new* blade. The lower trim stripe ends at the bottom of the fuselage. Holes on the front end can be painted on (faked) with flat black enamel that comes in those little bottles for painting plastic models. It is also good for doing tires.

You can cut the lettering out of black tissue if you have a lot of patience, or you can use the little "press-apply" decal that comes in the kit. This must be cut closely and applied with *great care*, barely touching the center only until it is exactly where you want it. Once stuck down it will take your tissue off if you try to pull it up. Work it down with the edge of a bit of sheet balsa used like a squeegee from the center outward once it is in place. Get all the bubbles out. Also, remember that a fingerprint on the back side of the decal will be forever a part of your model. Spray the finished job lightly a couple of times with Testor's Dull-Cote to kill the shine or it will look *bad*. Some types of hair spray might do the same thing, but don't experiment on your model. Try it on something else first.

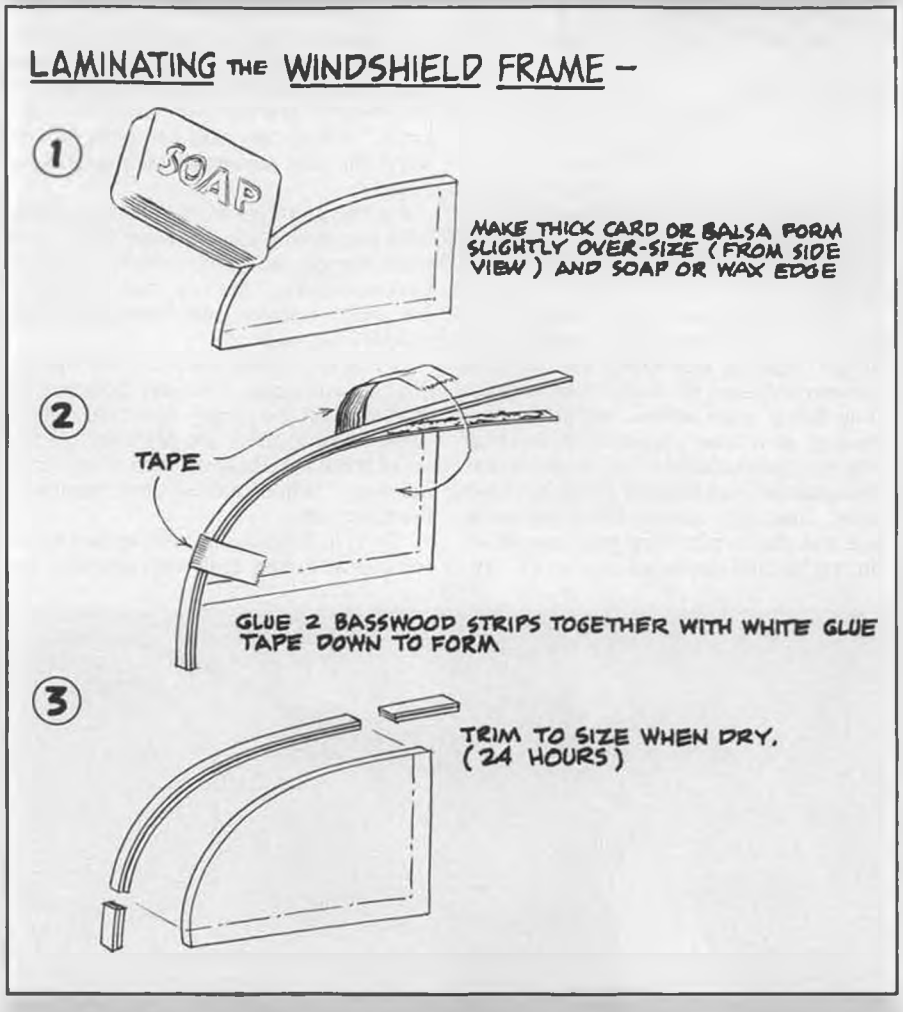
**CONTEST FLYING**

Flying a model in a contest is not much different than flying it out in a field all by yourself. The main difference is that you will be nervous and make dumb mistakes, that's all. Never go to a contest with a new, untrimmed model like all of the rest of us do. Know your plane and how it flies. Still, if you need help getting it to fly, what better place to get help than at a meeting of expert modelers! Nine out of ten will be flattered if you ask questions and will probably offer more help than you can use!

Many contests require that you belong to the AMA (Academy of Model Aeronautics), and you should be aware of this before going. It is mainly for insurance purposes, and unfortunately a kid with a half-ounce rubber model pays the same fee as one with a five-pound R/C model that travels at 100 mph. It's also a good idea to ask what the rules are at the beginning of the contest so there will not be any hard feelings or misunderstandings later on. There are several different sets of rules used today in the US and the world in the Peanut Scale event, and about the only thing they have in common is that they all require flight and "static realism" points both to be added up to give you your contest place. Don't be afraid to fly just because you are not the best flier there. You might be surprised! Even a blind sow can pick up a few acorns.



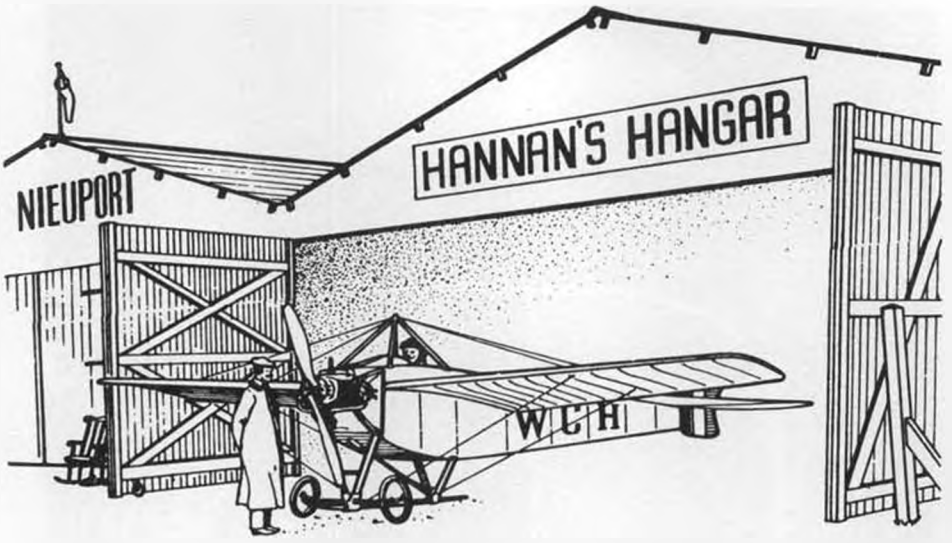
Curved windshield frame is made from two pieces of basswood strip laminated around a form with white glue. Use tape to hold it until glue has dried.




**SCALE PRESENTATION**

One of the things that you will need at most contests will be some proof that there was, indeed, a full-sized airplane like it and that you did a reasonable job in imitating it. As peanut contests are usually fairly laid-back events, the judges will often accept the plan from which the model was built. A three-view drawing of the original plane (included, incidentally, in your Peck Lacey

*Continued on page 73*




**"I never think of this hobby in terms of saving time; I think of it in terms of spending time. Isn't that what hobbies are all about?**

• Our lead-in line this month is by Doug Smay of the San Diego Ship Modeling Guild, via Bill Northrop. We thought it deserved sharing with our aircraft-oriented readers too!

**ERRATA AGAIN!**

Speaking of readers, we'd like to unravel some September *MB* typographical errors: Commencing with the Air/Space Expo article by Bill and Ken Hannan, ably assisted by Jim Alaback and Andy Mackenzie, the jumbled third and fourth paragraphs on page 68 *should* have said something more nearly like this:

"Note that the June *Model Builder* featured a control-line profile model of the Sukhoi. Having examined the full-size machine firsthand, we think it would make a fine flying scale model, and three-view drawings of it have appeared in the May 1986 *Air International*. The nine-cylinder radio-engined craft features a stainless-steel tubing fuselage, carbon-fiber/composite wing and titanium landing gear legs. In action, the Su-26M reminded us of an R/C pattern model, with its fantastic roll rate and effortless vertical performance.

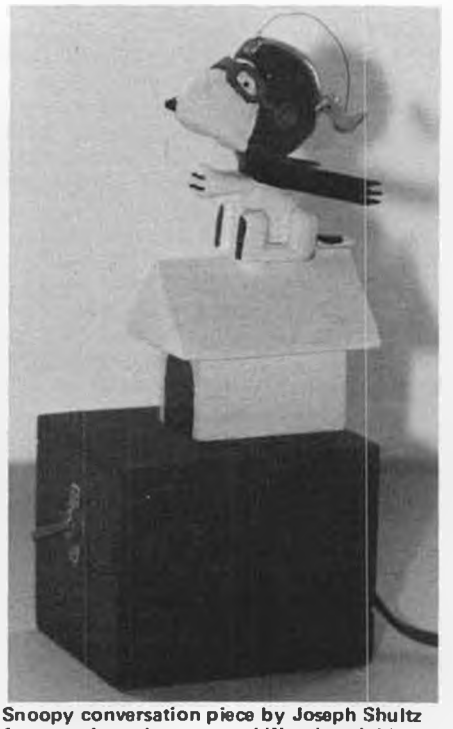
"The Mi-34 helicopter was also surprisingly maneuverable, repeatedly executing rolls, loops, and other antics. One intriguing specification on its display signboard: 'Maximum tail-forward airspeed, 130 km/h.'" Okay, now you can better understand the fifth paragraph on page 68, we hope!

But the gremlins were still not finished with tormenting us: On page 50 of Hannan's Hangar, under the heading "Also In Czechoslovakia," the first two paragraphs are okay; however, the third paragraph *should* have said:

"Initial tests established that the intent of the new rules was achieved; however, the workload on the judges was excessive, so some modifications are planned." At that point there *should* have been a new topic heading, "Schoolyard Sixteen" beginning the topic with:

"Dr. Will Nakashima, well-known for his whimsical model building cartoons," etc.

Apologies all around.



**Snoopy conversation piece by Joseph Shultz features tiny wire-mounted Woodstock bird which oscillates and orbits around Snoopy's head at 30 rpm.**

**THAT EZEKIEL AIRSHIP**

In an earlier Hangar column we mentioned the reproduction of the Ezekiel Airship on display in a Pittsburg, Texas, restaurant. The original, designed by the Reverend Burnell, was allegedly "briefly airborne" circa 1902. Al Backstrom examined the reproduction and says that it was based upon "local information and a stock certificate drawing." Aerodynamic propulsion was evidently via a paddle-wheel system interconnected with the landing gear wheels. In Al considered opinion, "If it did fly, the driver would only have been a passenger on his way to the scene of an accident." However, Al assures us that the restaurant serves good food and markets some very impressive T-shirts bearing the likeness of the Ezekiel Airship!

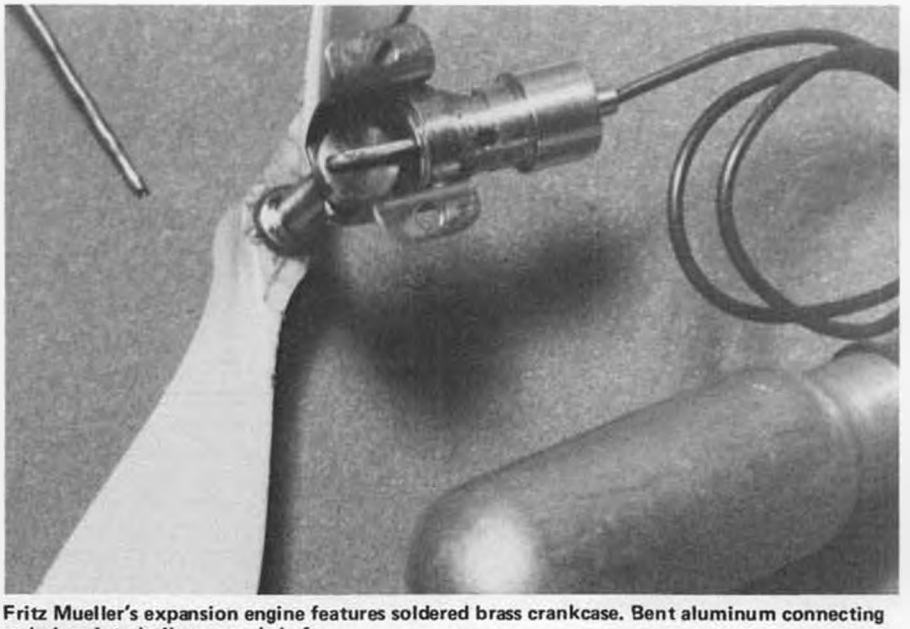
**SPEAKING OF T-SHIRTS**

Well-known scale modeler and art director Bill Noonan has developed a new line of T-shirts. These are not ordinary T-shirts, but 3-D T-shirts with startling in-depth illusions. Each garment is supplied with special viewing glasses and a handy stowage pocket. Although various graphic designs are offered, model builders should be especially attracted to one shirt featuring an F-14 jet fighter and our favorite called Sky Ace, emblazoned with a Sopwith Dolphin and a Fokker D. VII.

The 3-D T-shirts are available in Small, Medium, Large, and Xtra-Large at $11.95 each, plus $1.50 postage and handling from: LOOX, Box 86623, San Diego, California 92138. Tell Bill *Model Builder* sent you!

**FABULOUS FAC NATS**

The Flying Aces Club has triumphed again with the world's largest gathering of flying scale models. This "Oshkosh of free flight," conducted this year by the D.C. Max-



**Fritz Mueller's expansion engine features soldered brass crankcase. Bent aluminum connecting rod plugs into built-up crankshaft.**


A glimpse of the fascinating variety of full-size aircraft in the Museum of Flight in Seattle, Washington. Photo: Pinkston.


One of the many large-scale models exhibited in the Seattle museum.

icuters, attracted 122 contestants who entered 467 models!

Events included rubber-powered scale, power scale, Jumbo scale, Peanut scale, and Embryo Endurance, plus mass-launch events for WWI, Golden Age, Thompson and Greve racers, and WWII. The variety of entries was astounding, and the ambiance of the meet was in keeping with the FAC tradition of "Fun First." Care to see highlights of this remarkable happening? Colonel Dean C. McGinnes will send you a copy of his lengthy video tape. Informal coverage includes scale judging, flying action (including Don Srull's astounding electric Dornier X and Dennis Norman's rubber-powered Avro Lancaster) plus awards ceremonies with such celebrities as Earl Stahl. Price is $19.95 plus $3.00 postage and handling from:
Col. Dean McGinnes, 1503 Clairdale Lane, Lakeland, Florida 33801.

**INTER-GNATS**

Action on a smaller scale took place during the 1988 MIAMA Pistachio Inter-Gnats, with 32 entries representing 5 countries (Canada, England, Japan, Switzerland, and the USA). Unusual models included helicopters, canards, and even a saucer-winged Nemeth "umbrella plane." One entry spanned a mere 3-3/16 inches, prompting contest promoter Dr. John Martin to ask: "Can there be a limit to this smallest scale model madness?" (Our guess is no.) Results were:

*Category I*

1. Mark Allison (USA), Bleriot Canard. (Longest flight duration: 1 min., 32 sec.)


Looking like a giant Walt Mooney model, this Japanese ITOH Eaglet is displayed in the Seattle-Tacoma airport lobby, complete with three-view drawing.

2. Mike Arak (USA), Alco Sport.
3. Jiro Sugimoto (Japan), Dornier Komet.
4. Juergen Kortenbach (Canada), Sky Crane helicopter.

*Category II (2 to 3 grams)*

1. Don DeLoach (USA), Lacey. (Duration: 1 min., 5 sec.)
2. Kevin Smith (USA, BD-5.
3. Millard Wells (USA), Caudron.
4. Charles Slater (USA), Sky Hawk helicopter.

*Category III (over 3 grams)*

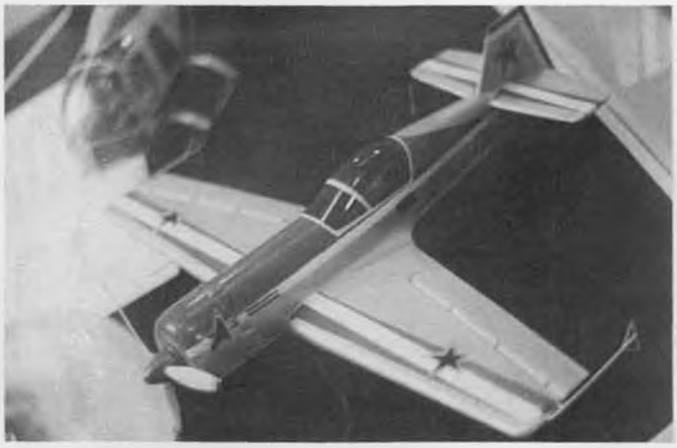
1. Millard Wells (USA), Fokker tripe. (Duration: 45.4 sec.)
2. Jiro Sugimoto (Japan), Folkerts SK-3 racer.
3. Millard Wells (USA), S.E. 5.
4. Nick Peppiat (England), Bonzo racer.

Proxy fliers included Arak, Wells, Slater, Hedley, Everson, and Martin. Mike Arak made a video tape of the proceedings, and *may* market copies if enough interest is shown. You can contact him at: 10900 S.W. 61 Court, Miami, Florida 33156.

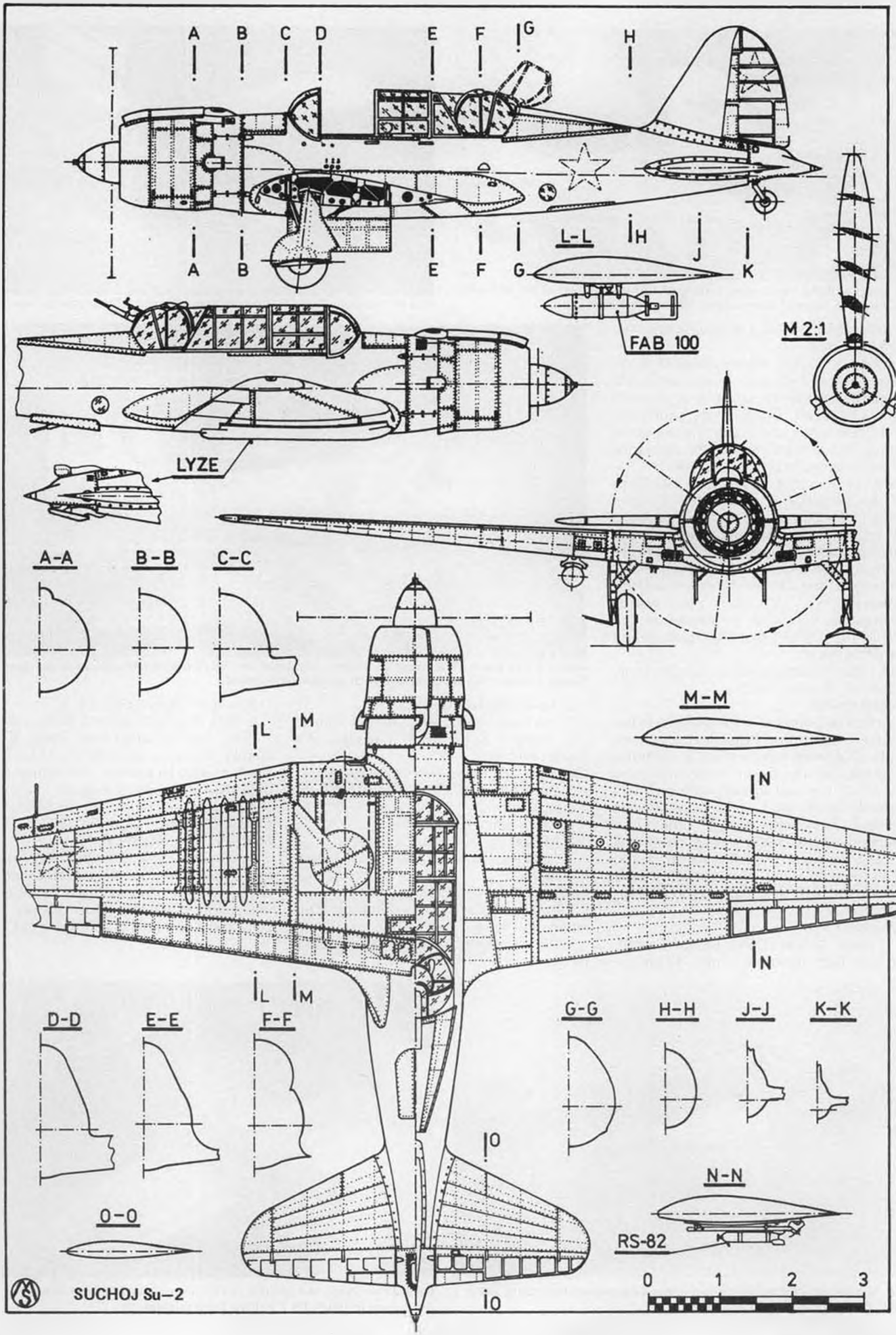
***INSIGHT* ON MODELS**

*Insight* magazine must number many enthusiasts among its audience, since article copies were forwarded by Dr. David Goodman, Don Campbell, Walt Mooney, S.B. Pell, and Ken Hamilton! Their focus was


The Sukhoi Su-26M aerobatic monoplane described this month along with the aerobatic Mi-34 helicopter.



Su-26M aerobatic monoplane model presented to the San Diego Aerospace Museum by a visiting Soviet delegation.




THREE–VIEW COURTESY MODELAR MAGAZINE

# Ivan's Iron Dog

**By JOHN BERRYMAN. . .The P-39 was built like a tank; in Soviet service it proved deadly against the Nazi panzers. This model should be built very light for outstanding performance.**

• The P-39—the airplane nobody loved. Our own fliers called it the "Iron Dog." Minus its turbocharger, and shipped to the British, it was judged "unsuitable for combat" in Europe. We even tried to sell a few to the French, but the country fell before they arrived. Saburo Saki, the famous Japanese Ace, shot them down in droves. Quite an inauspicious beginning for what may have been the first single-engined fighter to exceed 400 mph in level flight.

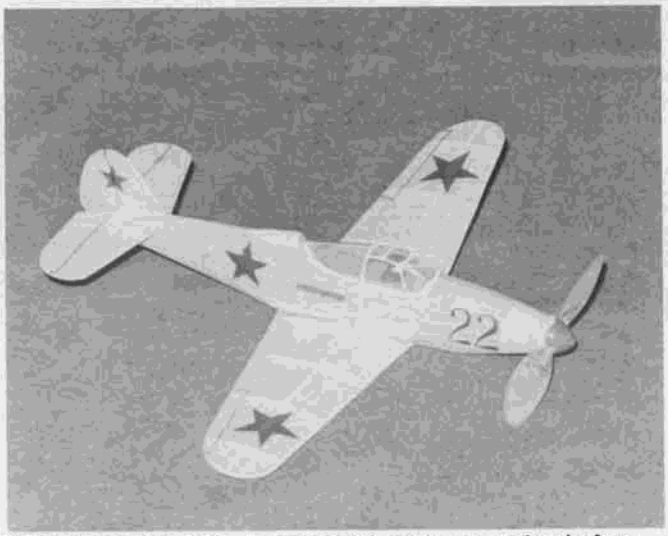
But the Russians, who were starving for aircraft of *any* description, used them, and used them well. With its powerful 37mm cannon firing through the spinner, it was an efficient tank-buster in the early days of the war. Its trike gear must have also made it amenable for use on primitive Russian airfields as well.

**Author describes easy-to-build balsa prop that is efficient and very light.**

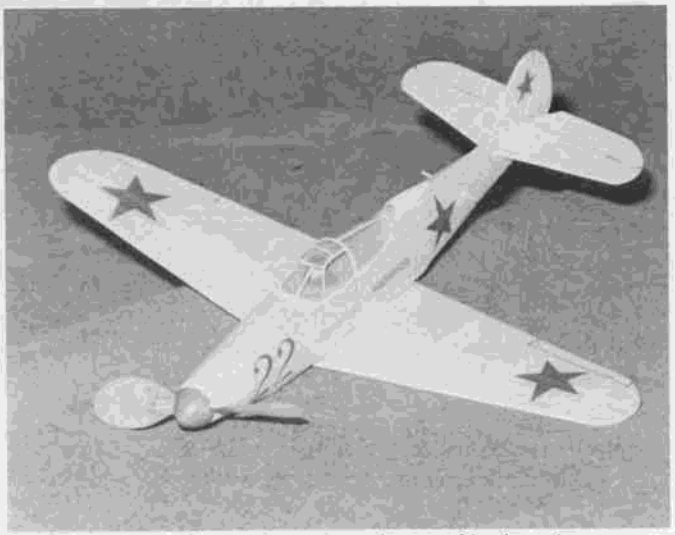
If anyone *ever* loved the P-39, it had to have been the Russians and we modelers. *Finally*, a WWII fighter with a decent nose moment, a fair-sized tail, and a bit of 1930's "Bill Barnes-ish" panache, as well.

This peanut model may look familiar to those of you who were fortunate enough to

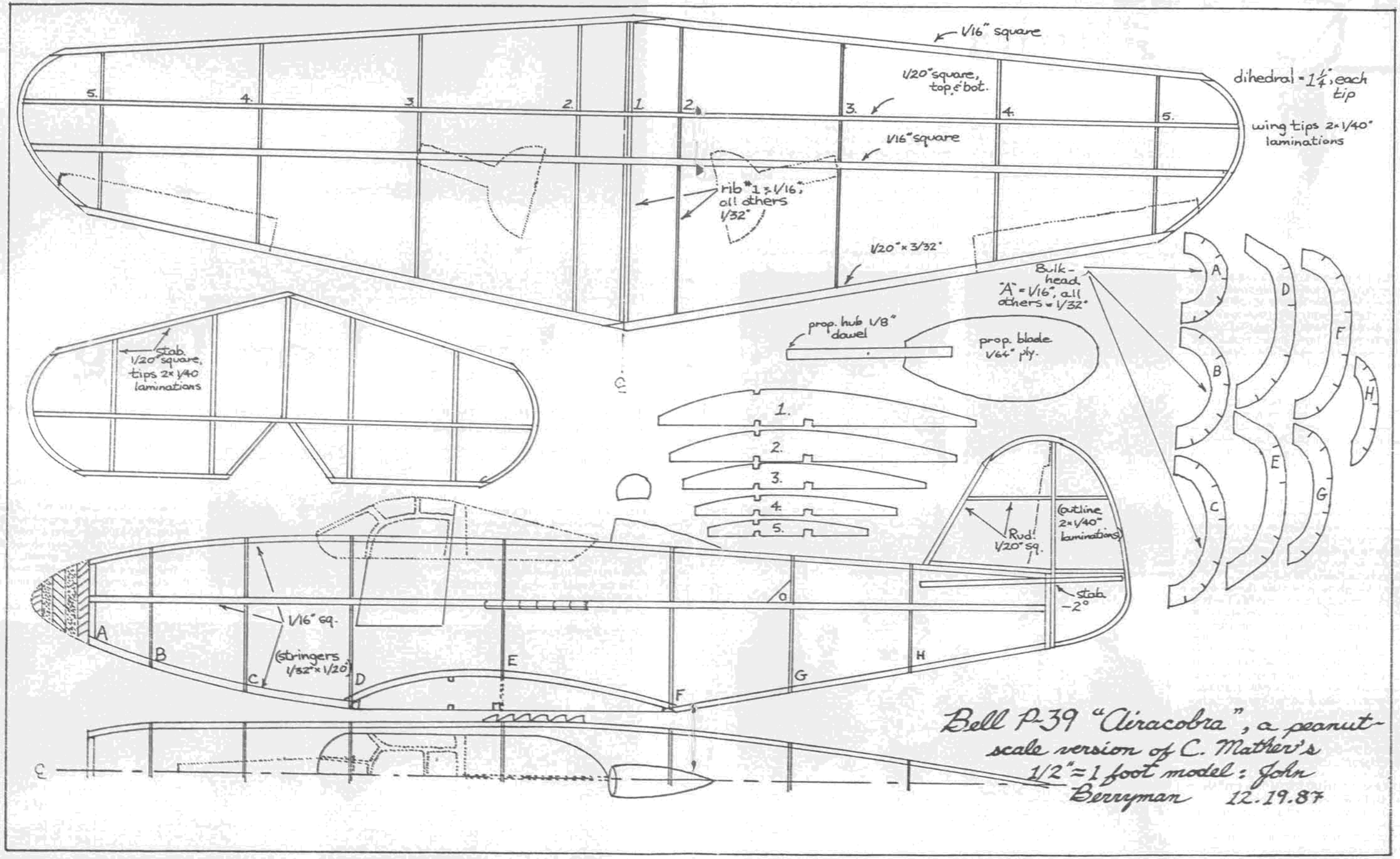
*Continued on page 76*



**Simple lines of the P-39 are very pleasing to the eye, and make for a good flyer. Light construction is important.**



**The P-39 flew well after author removed some of its downthrust. The Iron Dog can perform beautifully in a small space.**


1/16" square
1/20" square, top & bot.
dihedral = 1¼" each tip
wing tips 2×1/40" laminations
1/16" square
rib "1" = 1/16", all others 1/32"
1/20" × 3/32"
Bulk-head "A" = 1/16", all others = 1/32"
prop. hub 1/8" dowel
prop. blade 1/64" ply.
Stab. 1/20" square, tips 2×1/40 laminations
1.
2.
3.
4.
5.
(outline 2×1/40" laminations)
Rud. 1/20" sq.
stab. -2°
1/16" sq.
(stringers 1/32" × 1/20")
A
B
C
D
E
F
G
H
Bell P-39 "Airacobra", a peanut-scale version of C. Mather's 1/2"=1 foot model: John Berryman 12.19.87

# Free Flight

By BOB STALICK

• Boy is it difficult to begin a column with an apology, but I feel obligated to do so.

In the September issue of *Model Builder* "Free Flight," I baldly stated that Tom Cope was deceased. Nothing could be further from the truth. (I am reminded by the Mark Twain quote, "The reports of my demise are greatly exaggerated.") In fact, besides the usual phone calls calling attention to my error, I was graced with a letter from Tom's widow, Opie. The letter included both before and "after" pictures of Tom (see elsewhere in this article), and some sympathetic and well-placed barbs direct at yours truly. So you can get the flavor of this letter, I have excerpted a few choice passages.

". . . in case any of the engine collectors in the country are wondering what will be done with his engine collection, please tell them not to worry. One of Tom's last projects was to have a specially-built casket made for himself that included storage facilities for his engine collection, a New Ruler kit and plenty of Hot Stuff. . . ." ". . . if Tom's friends wish to make donations in Tom's memory, please forward the funds to me (cash, checks, money orders, etc.) identified 'To the Greatest.' I will see that the monies are put to good use, as a fitting memorial. Perhaps a statue at Harts Lake Prairie, or something equally fitting." Well, dear reader, you get the picture. I am properly, and once again, humbled. Perhaps those of you who wrote to Opie offering her your sympathy can now write to her once again offering a retraction. Fortunately life goes on, for Tom Cope as well as the rest of us. And please, don't ask how a seemingly intelligent writer could make such a mistake!

**DECEMBER THREE-VIEW: THE JULIAN, a $CO_2$ Design by George Benedek**

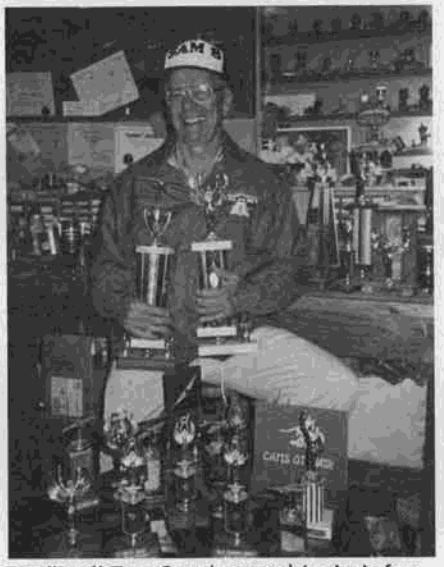
Last month, I alluded to some correspondence that I had been having with Fritz Mueller about the whereabouts and activities of George Benedek, well-known airfoils designer. Fritz, who lives in Columbus, Georgia, has been in contact with some of the Czechoslovakian, Hungarian, and German modelers who are experimenting with $CO_2$ ships.

Fritz noted, "Last year our good old friend, the Hungarian George Benedek, won the main event in Kladno with five maxes of two minutes each in dead air. This is remarkable, considering that he hadn't touched a modeling knife for 25 years! In 1960, he helped an American contestant repair his engine, and at that time, this was reason enough to be removed by some local 'officials' from the modeling scene. Don't worry; Hungary is now the most progressive country in the eastern block, and said "officials' are obviously on ice."

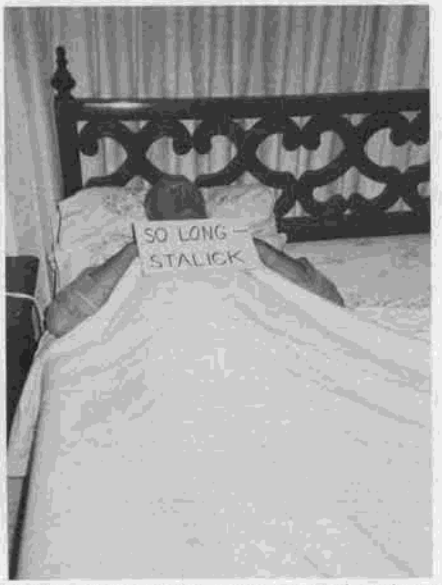
George sent along his drawing of the winning model, "Julian." Benedek's designs are always thoroughly planned and rigorously tested. Notice the slightly thicker airfoil with a slightly higher camber at the center wingpanel. Even the model weight he considers critical. The Modela $CO_2$ aggregate with prop weighs 30 grams (about the same as the rest of the plane). It glides in wide right circles by the effect of the vertical fin camber, assisted by the rudder tab. The powered flight is then adjusted by the 1.5 degree motor thrust to the right. Right banking is moderated by a 1-degree washin into the right wing tip. This, together with the prop torque, reduces loss of height by side slips.

One construction note about the model is that the top spars are recessed intentionally to avoid "humps" in airfoils where turbulation was not desirable.

The Modela motors are rare in this country, as the Czechs are not willing to export this motor any longer. Personal contacts in



The "late" Tom Cope(see text) in the before state. Tom is showing off a couple of his many trophies and a very neat workshop.




The "late" Tom Cope–after. Tom is just showing off in this picture.

Gollywocks Galore at the Gollywock Flyoff sponsored by the MACH group. From left, kneeling: Bob Thoren, George Batuik Sr. Standing: Carle Loehel, C.N. Purdy, Wayne Brock, O.C. Stewart (winner), David Durbin, and Russ Timmons. Photo: Tom Hepler.

Czechoslovakia might provide a source, and I understand that Bob Peck at Peck-Polymers, P. O. Box 2498, La Mesa, California 92041, has stocked them in the past. Perhaps he has a few left.

After you peruse the three-views, I am certain that the construction details will become obvious. Since the plans are stated in metric (as well as Hungarian), the measurements are readily translatable into the English system using the constant .03937. For example, the wing chord of 105mm x .03937 = 4.3 inches. The Hungarian is more of a challenge, so good luck with this translation!

**DECEMBER MYSTERY MODEL**

One of my regular correspondents, Jimmy Dean from Cedar Flats, sent in this example of a mystery model. This ship, designed by a famous free flighter who went on to become one of the better designers in the field of R/C models, was initially intended to be powered by the O.K. $CO_2$ motor. (This must be a $CO_2$ issue). My friend, Jimmy, noting that the projected wingspan was just at 30 inches, thought it would make a great design for a Pee Wee 30, so that's what he did.

So, do you know what the name of this ship is? You might riffle through your old issues of *Air Trails* to find out. If you think you know the design, send the name along with your name and address to Bill Northrop, c/o *Model Builder* magazine. A free, one-year subscription awaits you if you are the first one in line. Good luck!

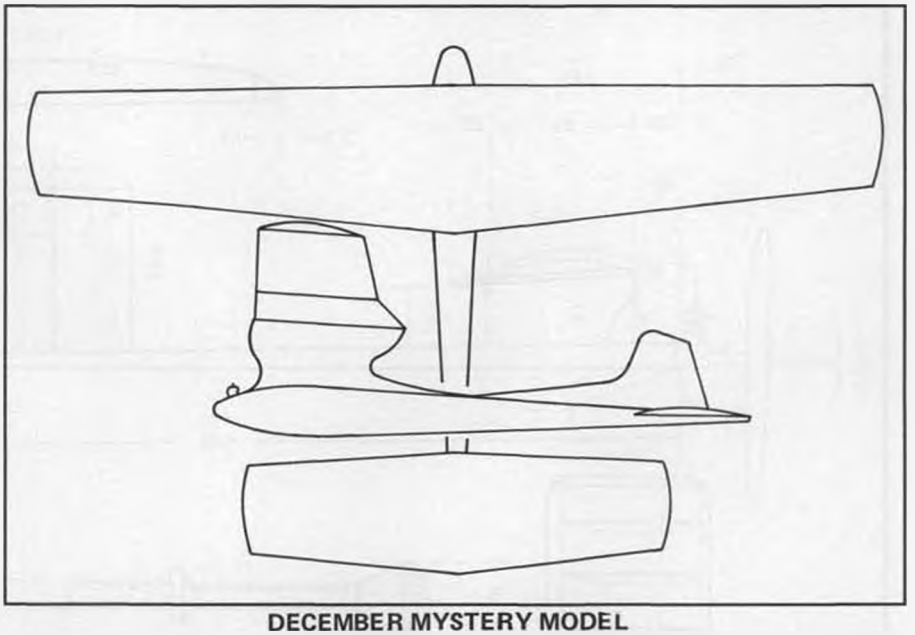
**DARNED GOOD AIRFOILS— BENEDEK 8452B**

In honor of the lead article on George Benedek, I thought it would be appropriate to feature one of his FAI Power (now F1C) sections. This one seems to have most of the characteristics common to today's F1C ships. It has a slight bit of undercamber, a raised (or Phillips entry) leading edge, and a forward high point. It might be just a bit thick, at eight percent, for the current scene, but that can be remedied with some judicious re-sketching. All sheet construction will take care of the potential structural or warpage problems with the thin trailing edge.

Give it a try on any streamlined, VIT-equipped gas model.

**BUILDING TIPS FROM THE *BAT SHEET***

The *Bat Sheet* is the newsletter of the Kent, Washington, Strat-O-Bats and is edited by Dennis Weatherly and Chris Weinrich. I am not sure which of thee two gentlemen gets credit for the following tips, so we'll just give credit to both of them.



**DECEMBER MYSTERY MODEL**

Tip #1: Storing Building Materials.

Now that you've completed your latest world-beater, there is a pile of three-views, templates (you do make templates, don't you?), special jigs and sanders, etc. that need to be stored. Last year, I latched onto a few Tyvek mailers that are 9 x 12 inches and work perfectly for this task. I label them with the model name and designer, then stuff all of the related goodies inside. They are tough enough that they won't rip out if overstuffed, and the Tyvek can handle the occasional "high humidity" in my shop. Now if my world-beater gets beat up, I have all the info in one place to rebuild it.

Tip #2: Drilling Engine Mount Holes the Easy Way.

Ever noticed how the bypass ports, needle valves and sundry other projections on an engine often keep you from getting a straight shot at the mounting holes? Here's a useful tip from, of all places, an old R/C newsletter! Wipe a thin film of oil (WD-40, castor, cooking oil, etc.) onto the top surface of the engine mount beams. Set the engine in place and align it. Now drop some corn starch down the mounting holes in the engine lugs, wait five to ten minutes, then lift the engine and blow away the remaining cornstarch. There will be four nice dry spots on the beams where the cornstarch has soaked up the oil! Just center punch, drill and tap, and you are all set.

**ADJUSTING MODELS by Ed Lidgard**

Ed Lidgard is one of the most prolific of the old-time modelers who are still active in free flight today. He has primarily done his thing with rubber-powered models to the betterment of this phase of our hobby. Read along as Ed provides some advice for all of us.

"The best place to adjust a model is at home. The best feeling in modeling is to launch the initial glide off a hill and have a nice glide, turning in the desired direction and have the firsthand winds produce a nice flight.

"These steps are essential before flight:

"1. Know the CG location.

"2. Know the angular difference (decalage) between the wing and the tail.

"3. Stabilizer and rudder flat with glide angle built in.

"4. Wing flat except for: A) washed out (less incidence) wing tips, minimum two degrees; B) predetermined trim such as right inner panel with added incidence (washin).

"5. Offset thrust: start with two degrees down and two degrees left.

"Many times at Mile Square Park, I've worked with beginners who have models that are *not* flyable. After showing the basic how-to-trim and how-to-remove-warps, the next flying session becomes more successful.

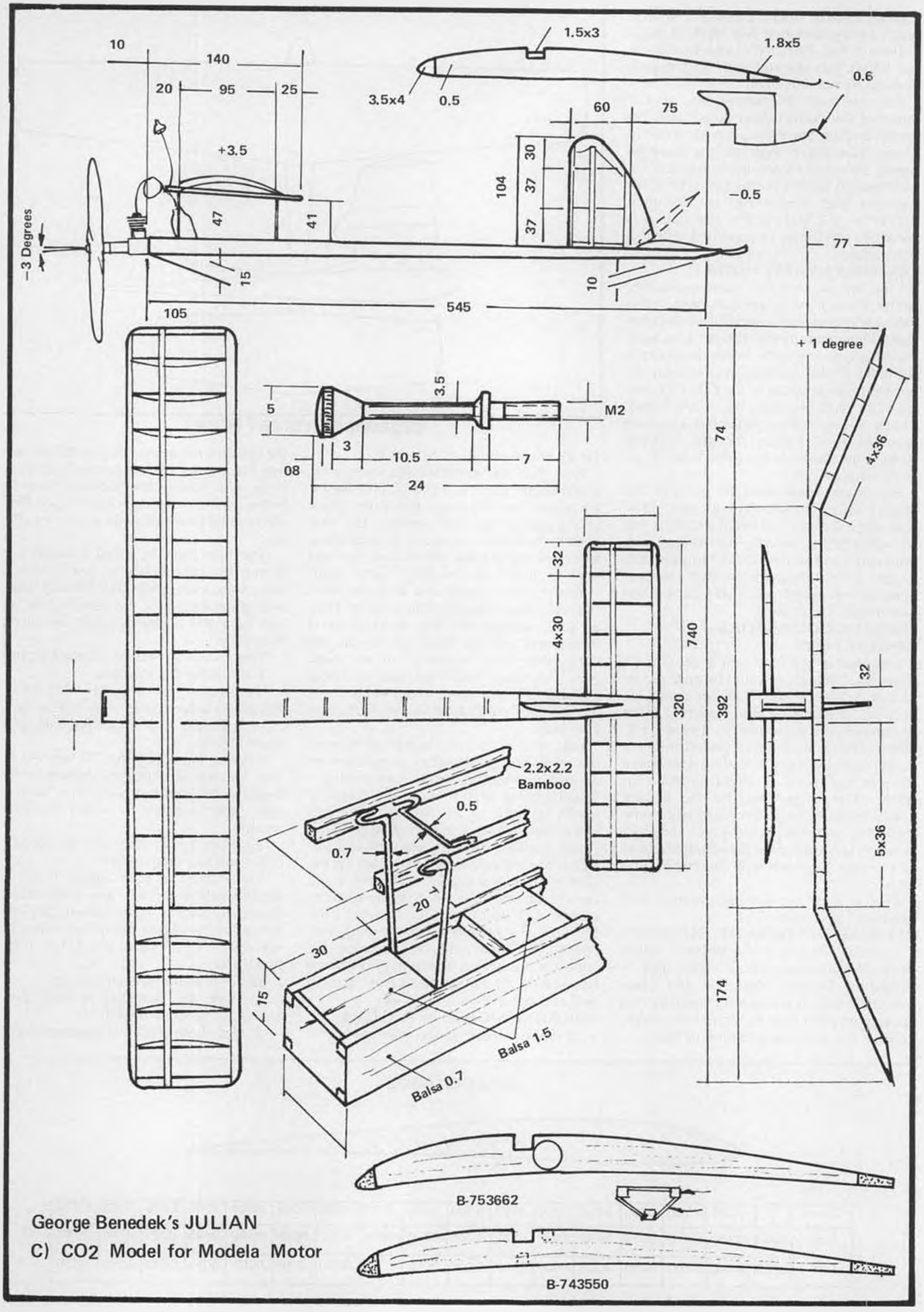
"Other fine-tuning essentials are:

"1. Have the propeller in track (both blades follow the same track).

"2. Have both blades of the propeller set

**BENEDEK 8452B**

| Chord | 0 | .0125 | .0250 | .0500 | .0750 | .1000 | .1500 | .2000 | .2500 | .3000 | .4000 | .5000 | .6000 | .7000 | .8000 | .9000 | 1.000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Upr. | 0230 | .0380 | .0470 | .0570 | .0640 | .0685 | .0745 | .0780 | .0800 | .0800 | .0760 | .0685 | .0580 | .0465 | .0325 | .0185 | .0040 |
| Lwr. | 0230 | .0130 | .0100 | .0055 | .0035 | .0020 | .0000 | .0005 | .0010 | .0030 | .0050 | .0005 | .0055 | .0055 | .0045 | .0025 | .0000 |




George Benedek's JULIAN

C) $CO_2$ Model for Modela Motor

at the same pitch angle. To be sure of this, build a guage when making the propeller and nose block so that the propeller can be checked accurately.

"3.Be sure the wing is on square with the fuselage. Add keys of wood to prevent movement or draw lines that are checked before each flight.

"4.Build a nose block that has a back plate that fits accurately into the fuselage nose and built so that it fits the nose only one way. Put marks on both to make the assembly easy. A pinhead of contrasting dope on the top is good.

*"So now you are ready to fly. .* WAIT!

"Where is your: winder, punk to light the fuse, lighter, shims for thrust and incidence trim, oil for prop bearing, spare rubber, fuse, rubber lube, clay for balance adjustment, rubber bands for assembling?

*"Okay, flier, you're really going to wind it up*—Where is your: stopwatch, inserting wire hook, Crocket hooks, water and paper towels for removing rubber lube, notebook to keep flight records, rubber turns, blast tube (to keep the breaker rubber from exploding your fuselage), winding stooge, table for all this stuff?

"Oh, well, it's still a cheap hobby. Don't forget to light the dethermalizer fuse."

**A PLEA FOR PLANS**

Does anyone out there have a set of full-sized plans for the "Firecracker"? This ship was designed by N.G. Marcus and appeared in the English magazine *Model Aircraft* in 1949. The ship is a pylon model and qualifies for the Ignition Nostalgia class. Anyone who has a set that can be borrowed for about a month will receive a free copy of *Darn Good Airfoils 3* for his troubles. The plan will be forwarded to Bob Larsh, who will arrange to make copies available for anyone else who might be interested. If you have a set, please contact Bob Stalick at 5066 N.W. Picadilly Circle, Albany, Oregon 97321. Thanks for your help in advance.

**SPEAKING OF BOB LARSH**

Bob, as most of the readers of this column must now know, is one of the real instigators of the Nostalgia movement here in the U.S. of A. Bob reports that the first-ever Nostalgia Champs, held in conjunction with the SAM Champs was a roaring success. He reports: "I have received a number of letters from interested champs visitors who had been away from modeling many years and wanted to see what was going on. When they viewed the action and the models we were flying, both O.T. and Nostalgia, they just went bonkers and thought time had stood still. They couldn't see any change from when they left the game. As a result, we will have new members in both SAM and NFFS. How about that!" Bob also reports, "We had three good days and one rainy, windy day. Unfortunately, Ignition Nostalgia was on the bad day, and only a few of the contestants flew. Winner was Elmer Jordan with a 1947 Phoenix/Arden .19. Second place was a Bob Cat with an Ohlsson .29 entered by John Bortnak. Third went to Tom Lucas with an Atwood Champion-powered Cleveland Playboy Sr." Added details of this meet will be

*Continued on page 86*

George Benedek holds his historic wing, while Stefan Gasparin presents to him the first-ever Modela motor.

George with a mouthful of rubber bands, prepping his 1958 Wakefield wing on a special fuselage for a three-minute max.

A typical $CO_2$ free flight launch as demonstrated by a Czech contestant: horizontal, nice, and easy!

# the INSIDERS

# INDOOR FLYING REPORT

By DAVE "VTO" LINSTRUM


**Insider workshop No. 2: The London shop of Peter Michel Smae is used by VTO to complete a model. Windows look out on sunny English garden.**

• Noted "Insider" Jim Richmond of Carmel, Indiana, a five-time F1D Microfilm World Champion, is one of the featured authors in the 1988 National Free Flight Society Symposium Report, now available from NFFS Publications. Not only is his "Inside Story" worth the price of the book, his world champ winning models are on the cover! In a nice piece of art by Bud Gordonier, Richmond's "Catwalker-style F1D is shown with a three-view of the model used to win the World Champs in Johnson City, Tennessee, last May. This latter model has an unusual variable diameter hinged prop, Kevlar spiral-braced motorstick with Boron compression braces.

Richmond's seven-page article, which features photos, tabular data, and lots of tips, is only one Indoor item in this info-packed volume. Indoor Ace Walt Van Gorder had his "Manhattan Pieces" selected as one of the 1988 Ten Models of the Year. A three-view and photo/text describes this AMA Record holder. Frank Cummings, a noted indoor flier from California, is honored in his NFFS Free Flight Hall of Fame bio sketch.

The Symposium Report, the 21st one published by NFFS, is chock full of other articles of interest to the avid free flighter. Since there are few "Insiders" who devote their time exclusively to Indoor, we know you will enjoy articles on subjects like airfoils, slotted tips on bird wings, and composite materials. The 25 articles and other features, compiled by Editor Herm Andresen and sidekick Sal Fruciano, makes this one a keeper in your library!

**Insider workshop No. 1: Bill Booth Jr. in his tidy garage shop in San Diego, sharing space with homeowner tools.**

For your copy, send $16 check or M.O. (postpaid in USA) to NFFS Publications, Fred Terzian, 4858 Moorpark Ave., San Jose, California 95129. Order your copy today.

**NFFS GREAT BOOKS BY MAIL**

If the above-mentioned Sympo Report isn't enough to keep you reading by the fireside this winter, we suggest the following from NFFS Publications (address above). The first one is a must-read for all "Insiders." It covers indoor flying from A to Z. Note the prices postpaid by 4th Class Mail in USA only. If you live overseas, add an appropriate amount for postage and remit in U.S. funds. Be sure to tell NFFS that "Insiders" sent you.

*Building and Flying Indoor Model Airplanes*: New revised edition by Ron Wil-


**Another obscure aircraft from Al Backstrom of Texas is this 8-inch span XFY-1 Pogo. Prototype was Navy VTO fighter for shipboard use.**

**Al Backstrom's Arnoux Simplex racer from 1922. See text for details on this all-balsa indoor scale model.**

Carl Fries launches his fully wound EZB from floor level, a technique that prevents its climbing through the roof of a small St. Louis flying site at a college gym.

Roy White of St. Louis transfers a fully wound motor from the torque meter to his AMA Indoor Record Holding Ornithopter.

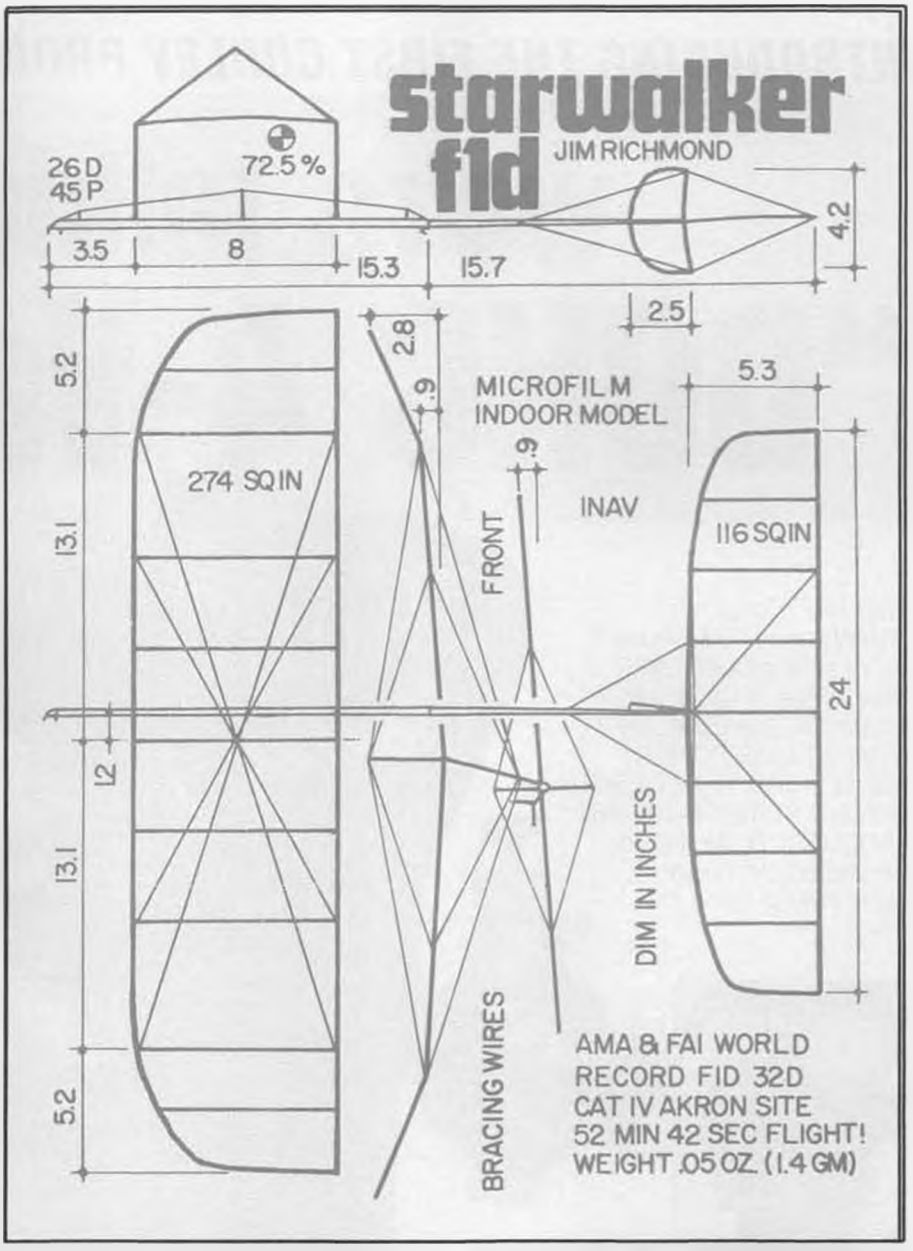
liams. A comprehensive and informative book about building and flying indoor model airplanes from simple to complex designs. Excellent line drawings and illustrations demonstrate modeling and flying, and a lively and lucid text makes this hobby accessible to both the beginner and the expert. Williams's book explains everything; from how to cut, taper, glue, slice, roll, brace, sand, and splice to flying the finished model. Source material and related publications are also provided in an extensive appendix. NFFS members: $14 postpaid.

*Fifty Years of Aeromodeller*: Compiled by Vic Smeed. "The unfolding pattern of UK aeromodeling as illustrated by a huge range of excerpts from the pages of *Aeromodeller*, which completed 50 years of publication in 1985. A must for all nostalgia and vintage enthusiasts. Almost 200 plans to scale, about 100 illustrations." 96 pages. $13 postpaid.

*Model Flying—The First Fifty Years*: by Vic Smeed. "The early history of flying model aircraft to 1950 illustrated by scores of plans from many countries and reproductions from a range of magazines—a book no vintage enthusiast will want to be without." 96 pages. $14 postpaid.

**HINT OF THE MONTH**

From noted photographer John Oldenkamp of the San Diego Orbiteers, this HOTM: Try the new Kodak T-Max 3200 black and white film. It requires no flash and solves many problems in poorly lit indoor sites. The 3200 ASA film can be processed by Kodak; ask your local camera shop to handle it. We are going to try T-Max too at the next MIAMA Club meet at MacDill AFB, Tampa. Look for those photos in 1989 "Insiders."




**IOWA INDOOR SEASON**

Famous Sig designer and sport flier Paul McIlrath sent us this note on upcoming events in Cedar Rapids:

"I always enjoy your column, especially the devil-may-car antics of Doc and his comical sidekicks in the world's only underwater squadron.

"I can't remember whether you printed notices of scheduled flying sessions, like Tenny, or not. But if you do, our group would appreciate a mention.

"We fly regularly from November to March at Kirkwood Community College. I would be glad to send a schedule to any interested area fliers as soon as scheduling is firm.

"Paul McIlrath, 1524-48th St. N.E., Cedar Rapids, Iowa 52402.

*Continued on page 75*

Five-time Indoor World Champ Jim Richmond of Indiana seen here with Starwalker on model box at West Baden.

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| 2120015 | 15% | Premium Sport, Straight Synthetic | 15.95 | 10.75 | 10.15 |
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| 3130020 | 20% | Byro-Jet, Synthetic/Castor | 17.50 | 12.50 | 11.75 |
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**Control Line. .** *Continued from page 27*

some notes. Go home and build your own!

Class I requires no shutoff because the integral tank makes it impractical. A "hot glove" electrical contact for the pitman's hand is allowable but unnecessary if you use a second crewman to operate the battery. KK engines, or KK tanks, provide fast-fueling capability, and a KK fine-thread needle valve backplate makes tuning easier.

Races are three-up, with 50-lap preliminary heats and a 100-lap feature. Piloting is relatively easy, but the pilots must be alert to wind conditions, particularly on takeoff and landing. It takes a little more work to drag these little planes off the ground in the wind or to whip them around to their pit areas than it does for the bigger, heavier planes. As far as pitting goes, once you've practiced enough to learn how to tune and warm up the little engines, it's just a matter of winding up the spring and letting go; they're almost a guaranteed first-spin start! (Make sure they're running forward before you let go of the plane; reed valve engines will happily run either way.)

Class II Mouse race takes the world of itty-bitty engines into the high-tech world of all-out racing with all the trappings except the expense. Engines are unlimited except for displacement, and airplane design is basically unlimited.

The usual engine here is the Cox Tee Dee .049 or .051. A KK custom engine is available, but I've found that the stock engine with proper break-in is competitive almost anywhere. It's hard to improve on the factory product in this case. However, the KK fine-thread needle valve assembly is a must.

The Tee Dee is a standard front-intake engine, and in this small size is a little more cranky than the reed valve, but it puts out much more horsepower. With a little practice, the pit crew can become as adept with these engines as the reed valves. (Resist the temptation to rework these engines, especially if you're new at it. Reworking almost always makes them harder to start, unless you're a professional like KK's Joe Klause.

Class II allows the use of shutoffs, fastfill tanks, pressurized fuel systems, etc. With the additional horsepower, the rotational speed of the Class II planes is nearly the same as Rat Race, but the tremendous pull that makes Rat difficult is not there.

My advice is to become proficient in the reed valve class before trying the unlimited class. In fact, Class II Mouse is not necessarily the logical next step from an easy class like Class I Mouse. Most fliers find a bigger-displacement class easier to work with when learning how to use the trick gadgetry of all-out racing, and the bigger planes in the limited classes are a bit slower going 'round because of their longer lines, and they're easier for novice pilots to take off and land.

A word about lines: One of the most difficult aspects of the Mouse Race classes is handling of the tiny lines. You must make up the ends carefully (see the AMA rulebook for instructions) and treat them with extreme care. Single-strand lines can spring off a reel into a hopeless tangle if carelessly handled and are easily damaged. They are, however, stronger and faster.

In addition to single-strand lines, every serious Mouse race competitor will have on hand a set of braided lines for use in rainy conditions. Mouse race planes are so light (normally five to six ounces) that they don't pull very hard. In rainy weather, lines get sticky and, with the light pull, may lock up altogether. At the very least, fliers should have a clean rag on hand and wipe the lines from plane to handle immediately before each flight in rainy weather, and then don't let them touch the ground again. When racing in heavy rain, the lines can get sticky in flight, and the braided lines may be absolutely necessary. Readers in the South may be able to disregard this information, but for those of us who race all winter long in the drizzly weather, take it from one who has lost more than one race from sticky lines: "When it rains, use your braids." The rulebook also contains a pair of events called "1/2-A Scale Race" (Goodyear). These are basically the same as the Mouse Race classes, with the exception that the airplanes must have the appearance of a real racing plane. See the rulebook for details and check the schedule of contests in your area to determine whether the scale classes are flown in your area.

**SPORT RACE**

This is an event that you will not find in the AMA rulebook, but it probably is the most common entry into racing, and into competition, in most areas of the country.

Because the rules are not unified nationwide, there are a number of varieties of sport race, but most of them are attractive to newcomers because of their simplicity and, in some cases, their compatibility with sport planes that most casual sport fliers might have in their workshops without building anything new.

Other attributes of sport race is that the planes are large and fly on long lines and have flying characteristics familiar to the casual flier. Anyone who can fly a Ringmaster can handle a sport racer.

The simplest sport race events, and the most attractive to the newcomer, are those that require a kit or very simple airplane and prohibit such trick racing gadgetry as shutoffs, fastfills, hot gloves, swing-weight carburetors, etc. In many areas this event also specifies the engine as a stock Fox .35 stunt engine, a common, inexpensive, docile, and easy-to-handle sport engine with which most casual fliers are familiar.

An example of this event is Northwest Sport Race, flown in the Pacific Northwest and some places in California and Utah. It requires kit airplanes or accurate reproductions of kits, Fox .35 stunt, and no racing gadgets. Also popular in a number of areas is the Foxberg event, requiring a Fox .35 stunt and a Goldberg kit such as a Shoestring or Buster.

Moving up the ladder, one finds sport rac-

ing events that have less limited airplane and engine specifications. These become excellent stepping stones for people who want to begin learning the feel of the true racing plane, going a little faster and with a bit more stable handling. These events allow more open design, use of such gadgets as fastfills, hot gloves and shutoffs, and a bit more variety of engines.

Once a beginning racer has learned the pitting and piloting techniques of the sport classes, it's not too big a jump to add the extra speed of the intermediate sport classes or to begin learning how to build and operate such items as shutoffs and fastfills. This hardware, particularly the shutoff, is the kind of thing that looks difficult to a novice but is not really much trouble, especially if you have an experienced person to help you set up your first one. It is, however, something extra to think about in pit stops that you don't need when starting out.

Examples of the more popular intermediate events include Northwest Super Sport Race, Midwest Sport Race, and Florida Slow Rat. These events normally require plain-bearing, single-bypass .35 engines, either stock or reworkable using original factory parts. Airplanes are of the built-up type similar to AMA Slow Rat planes, but normally prohibiting inboard tanks and swing-weight carburetors.

Also popular in some areas is the "quickie rat," using Sport .40 engines, solid wings, and profile fuselages, and there is a "Big Goodyear" event using scale-like built-up airplanes and a limited fuel tank capacity.

For comparison, speeds in the Fox .35 sport race events tend to run up to about 80 mph, while Northwest Super Sport, Midwest Sport Race, or Florida Slow Rat will run up to about 100 mph. Quickie Rat and Big Goodyear, which in some areas has fewer engine restrictions, will be a little faster still.

Races normally are of the 70/140-lap format with three up, or even up to four in the air in some of the Fox events.

If you are a casual sport flier and want to try out one of these events, you may find the plane to do it hanging on your workshop wall. If not, you can build one from a kit, or by getting information on a good design from your local area fliers. Make sure to check the specifications in your local rules.

One bit of advice: You are not building a "stunter." Make sure to build your plane a bit on the nose-heavy side and set up your controls for minimum elevator movement. Your controls should be set up with the leadouts in the outer holes of a three-inch bellcrank and the pushrod on the inner hole. The pushrod should be on the outer hole of the elevator horn. The result is a plane that is very stable and moves very smoothly with fairly large arm movements by the pilot. You don't want the plane bobbing around in the air, causing problems for you and the other pilots! If you're using a sport plane for your first race, be sure to detune the controls and use a handle with a narrow line spacing, such as a Fox handle with the lines coming through the narrower set of holes.







## SCALE RACE

As we move into the more difficult events, I will say less about each event because we begin to move away from the activities that will be practical for beginners. These events are, not necessarily by design, suited for racers with experience in the above-mentioned classes looking to move on to new challenges.

One of the events that is more difficult than it looks, but still possible for the modeler with intermediate experience, is Scale Racing, or Goodyear. There are, unfortunately, a couple of other requirements that make this a little bit more of a challenge than some of the other events.

First of all, contestants find themselves digging a bit deeper into their pockets for this event because the engines required to be competitive with the trend-setters are considerably more exotic than in some of the events mentioned above. We are getting into names like Nelson and Rossi. On the local level, fliers may find it possible to compete successfully with such engines as Cox (Conquest), Cipolla, or Super Tigre, but eventually you will encounter the Nelson-Rossi crowd, particularly at big regional or national meets.

Second, it is a bit more difficult to find competition in this event, which was designed years ago as a beginner event and escalated into a much more difficult event.

The airplanes are attractive in appearance, with scale outlines and some decoration, but the "cute" appearance is betrayed by the scream of unlimited .15 engines turning in the neighborhood of 30,000 rpm. Engines in this size can be somewhat cranky for the inexperienced.

The small airplanes, despite their appearance and profile style, are full-race designs, with the construction style and handling common to all the faster classes. There are, however, a number of excellent designs available in published plans, and the construction, while perhaps different from that previously done by novices, is not difficult. Be prepared to spend a lot of time with sandpaper, epoxy, fiberglass cloth, polyester resin, etc.

Almost mandatory on Goodyear planes are a crankcase pressure fuel system, fastfill tank and shutoff. Hot contacts may or may not be used, depending on the crew's preference.

The planes are on 60-foot lines, which makes the rotational speed, when combined with the light weight of planes, fairly reasonable for the intermediate flier. New Goodyear pilots will notice that the planes have different takeoff and glide characteristics more typical of Rat Race planes than of the sport racers, due to the thin wings and small size. Pilots need to have learned some good takeoff and dead-stick flying skills by the time they tackle Goodyears.

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| CH0001 | Circus Super Starter | 29.99 | 21.99 |
| MCDRC101 | NI-HL-1 Ni-Starter (w/Charger) | 26.99 | 23.99 |
| CH0016 | 12V Wet Cell Battery (5.5 amp) | 19.99 | 12.99 |
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| CH0036A | 1.5V Glow Plug | 2.10 | 1.99 |
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| CH0001 | Circus Super Starter | 29.99 | 21.99 |
| CH0016 | 12V Wet Cell Battery (5.5 amp) | 19.99 | 12.99 |
| IM63003 | Silicone Fuel Line (Large) | 3.20 | 2.99 |
| MCDRC101 | NI-HL-1 Ni-Starter (w/Charger) | 26.99 | 23.99 |
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| K06030301 | Circus Training Gear B-28 | 16.99 | 11.99 |
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Races are 70-140, usually with two up but occasionally with three.

In some areas, the urge to fly the cute little scale planes is satisfied for the novice or less-serious fliers by the existence of a second class of Goodyear, sometimes called Class II or Sport Goodyear. This class uses plain-bearing or brand-specific .15 engines, slowing the speeds considerably. Check your local schedule.

**SLOW RAT**

You are now entering the major league of racing. If you haven't honed your racing skills on the classes mentioned above, go back to square one. This is not for beginners.

The airplanes, which follow specifications outlined in the AMA rulebook, look much like those of the intermediate sport racing classes (Super Sport, Midwest Sport, etc.), but there are some major differences.

First of all, engines are unrestricted except that they be of no larger than .36 displacement and have suction fuel systems. The open engine specifications lead to the development of some custom engines that are very expensive, and top quality racing .35s in a stock configuration are very hard to come by at present. Inexpensive ones that will compete at a top level are nonexistent. (However, I haven't yet seen anybody experiment with the new ABC Fox Combat Special. Could there be a breakthrough here?)

The second additional area of difficulty is in the lack of restriction on tank location, which results in the use of inboard tanks and a form of centrifugal pressurization that requires a swing-weight carburetor on the venturi to be successful. This carburetor changes the venturi opening as the plane picks up speed and begins to receive fuel under centrifugal pressure (without such a device, it would be difficult or impossible to set the needle valve on the ground, without the fuel pressure that will exist in flight).

The result of all this is that the planes take considerably more work and practice to set up and go considerably faster, up to 130 mph, than any of the others mentioned so far. A large, fairly heavy plane going 130 mph in traffic becomes much more of a handful to fly and becomes about the top level of racing that many experienced fliers can handle. Beginners probably would find themselves in trouble piloting this event.

Races are 70/140 with two up, though the rulebook allows three.

All the above having been said, a good Slow Rat race between experienced fliers is an exciting event for competitors and spectators alike. It's something to aspire to if you desire to get into serious racing and a necessary stop on the way to Rat Race. As with Goodyear, competition has become scarce in recent years, and you may find yourself traveling some distances to find races.

**RAT RACE**

Hold on to your hat.

This is the event that many consider to be the single most exciting competition event in all of Control Line flying. From the standpoint of physical requirements, it is unquestionably the most difficult. For those involved, the exhilaration is unmatched in any other activity.

Rat Race is racing *on the edge*. Equipment and especially pilots are taxed to their very limits. Speeds are above 150 mph, races are noisy, close, and it doesn't take long to go five miles! The difference between winning and losing often is a matter of two or three seconds over two heats or a feature race.

This is the event that nearly every racer eventually aspires to, but a beginner should expect it to take several years to arrive in the Rat Race circle.

In some senses, Rat Race is among the easier events. Once a plane is properly set up, the pitting is fairly easy. Rat Race uses unlimited-design .40 engines, which are fairly plentiful and affordable and quite easy to start and tune, once you get the hang of it. Pitting is almost entirely done by one-man crews, because the full-fuselage planes make a two-man crew impractical. Shutoffs, hot gloves, and fastfills are virtually mandatory, and crankcase pressure is the fuel system.

Approximately as much work goes into building a rat racer as goes into a huge precision aerobatics plane, with the exception of the finish. The planes are built of hardwoods and balsa, or of fiberglass, with a "top" that includes the wing, tail, and fuselage bolted onto a magnesium racing pan that includes the engine, landing gear, tank, shutoff, and controls. (Some variations on this style exist, most notably the inverted Rat with the pan on top and the fuselage on the bottom, with the engine inverted.) There are some good published designs and many unpublished ones on the contest trail. The best way to build that first Rat Racer is to find an experienced flier and obtain their assistance, but a lot can be learned on the field by looking and asking questions.

The chief element of difficulty in Rat Racing is the strength needed for piloting. Because of the large engine size, the tiny, fast, heavy airplanes pull tremendously hard. Combining that pull with the tremendous speeds makes good physical conditioning and a lot of racing experience mandatory. Even so, many racers choose to do their work in the pits and recruit others to pilot,

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which is why at many contests the same few pilots appear in all the races.

Races are 70/140. Two up only!

**FAI TEAM RACE**

This is the international racing event that is done at the world championships and a few other places. It involves the use of .15 diesel engines, full-fuselage airlanes, and a 7cc fuel tank limit.

Flown on 52-foot lines and using 100-lap heats and 200-lap features, this is the ultimate in high technology for racing. It takes a whole different set of skills in both pitting and piloting from the usual glow classes.

When you've tried everything else and still are looking for a new challenge or you'd like to represent your country at the world championships, this might be the event for you.

Be prepared to drop out of everything else and devote your life to team racing.

**IN THE CIRCLE**

Piloting a racing plane, at the beginner-event level, is the simplest of all CL piloting. It involves nothing more than the ability to take off, fly level at various heights, and land.

As they gain experience, pilots add a repertoire of other subtle skills that eventually build their competence. Use of these skills eventually separates the average acing pilots from the good ones.

*Taking off* occurs the instant the pitman has the engine started. Upon the "go" signal, the pitman will start the engine and release the plane immediately. Here, the pilot takes over by alertly moving his own body to the left, dragging hard on the lines to make sure of tension, getting the plane aloft to clear the next pit, and stepping inward on the circle to clear the next pit and to begin moving toward the center circle with the other pilots.

Takeoff should be smooth, soon enough to avoid the other pits but gradual enough to avoid interfering with planes in the air. Skyrocketing up through the traffic lanes will have a serious negative effect on your relationship with fellow pilots!

*Flying* requires alertness at all times. Here are some fundamentals:

*Height: Your plane should be high enough to clear any obstacle that might appear on the circle, such as a pit crew retrieving a plane, but below the height limit for your particular event (see the rules). Normally, flying as low as safe is recommended. Flying high decreases the distance around the circle but decreases the efficiency of your wing as well, so the advantage is reduced or negated. Furthermore, high flying interferes with faster traffic and runs the risk of penalty.

*Passing: Overtaking planes pass *over* the slower planes. Passing should be done smoothly to maintain top speed and should be done within one lap. Pilots should not start their pass too early, a common error.

Your handle and lines should pass over your opponent's head at the same time your plane passes his. Moving your handle over too early crosses lines, and invites disaster as well as causes problems for everyone in the circle. Similarly, passes should not be done too late, which crosses lines again and causes similar problems. Passing should be done below the maximum height. Leave enough room to clear the slower plane safely, but don't slow yourself down by making wild fluctuations in height.

*Flying: It should be smooth, without the plane bobbing up and down. Pilots should *keep up* with their planes. The lines should go straight out from your hand to the plane, no angle forward. (If they angle backward, you may be called for whipping, which is a violation of the rules.) Pilots who fall behind their planes, a common beginner error, cause all kinds of traffic problems in the pilot's circle and in the air, and the offending pilot finds himself scrambling madly to catch up, which can be dangerous.

*In the pilot's circle: Pilots should walk as tight a circle as possible, and they must *walk* the circle (as opposed to pivoting) even when alone in the air. The ideal piloting posture is to walk so small a circle that the handle itself does not move from the center as your body, leaning back against the strain, moves around. Advantages of walking a tight circle are that your plane goes the least distance (faster!) and the pilot covers less distance as well. If all pilots are walking properly tightly, they all will be shoulder-to-shoulder in the center and, if there are more than two up, will have to push in a little to take a new position after a pass (give way to pilots trying to squeeze in!). If you find yourself racing and having no contact with the other pilots, you may be flying too loosely, causing problems and going slow! Rule violations in the center include whipping (trying to tow the plane around faster than the engine will carry it) and backsiding (walking the opposite side of the circle from the plane, in an attempt to shorten the flying distance).



*Landing* is one of the pilot's biggest challenges. If you are flying an event with no shutoff, you must be alert to your plane's fuel status and begin your tow to the pits the instant the engine dies. Without a shutoff, you may have to go longer or shorter distances, depending on the timing of the engine's quitting, so extra alertness is necessary. Shutting off requires some pilot courtesy, so that your up-and-down wag of the plane to activate the shutoff with the down line does not cause problems for the other planes. You may have to wait a lap or two before shutting down. Once you've shut down, you should glide your plane into the pits in the shortest distance, shaking the tail to brake if necessary or gliding smoothly if you're farther out. Touchdown should, if possible, be after passing any pits with planes down (remember to stay inboard!). Your plane should come into the pit while still moving rapidly so that you don't lose time rolling to a stop. And you must come to the pit. Having the pitman chase the plane around the circle is definitely losing technique. When landing, the pilot should exit the pilot's circle and move outward to the next circle, the pitting circle. Don't lounge around in the pilot's circle or the zone in between circles and get in the way while your plane is in the pits. If you are finished and others are flying, sit just outside the pitting circle. Keep your head low when your plane is down.

**PITTING**

An entire article probably could be written about pitting technique. I will not attempt to go into detail on all the ins and outs of pitting each style of plane and engine, but I will offer a few general tips and examples.

Before the race begins, a pit crew should organize what it will take to the circle. *Important: Do not take more than you need!* The pit crew should carry a small basket containing only the most essential items: fuel bulb, prop/plug wrench, spare plug, spare prop, finger protector, battery (if it's not strapped on your arm). Fight the temptation to take your whole toolbox, glue, lunch, pop cooler, etc. Every single unnecessary item in the basket will get in the way and slow you down! If you have a problem so serious that you need a pliers or screwdriver or glue, you've lost the race anyway, so you might as well leave it in the pits and risk having to run get it.

Second tip: Don't hurry. You have certain simple tasks to perform in the pit. Do them carefully and deliberately and get them right the first time, and it won't take much time. You will lose more time fumbling, trying to go too fast, and fouling things up than you will being deliberate and getting things done right. Watch the fastest pit crews to see this concept in action.

On the initial start, you have plenty of time to do things right. Before you get to the circle, you should have checked your glow plug and replaced if necessary, tightened your prop, etc. Once at the circle, fuel up, prime, and arm up the engine. With most events, I find it advisable to warm up the engine as soon as the two-minute count starts, and then run it again every 30 seconds, with the last warm up being done after the 30-second signal. Keeping the engine warm avoids the need for a prime (remember, a hot engine usually doesn't need, and shouldn't have a prime). You should have done this enough times in practice that you know exactly what sequence will make your engine start on the first flip. Connect the battery at five seconds (not too early, so that the fuel burns away). Make the first flip after the "go" signal, a very smart, solid one. Learn your engine well enough to know whether it wants to be flipped forward, smashed backward through compression, backward away from compression, etc.

It's the pit crew's job to keep track of the laps and the race situation and decide when to call the pilot down for a pit stop. Decide whether you want to pit while others are flying or when they are down. You should have worked out a series of hand signals so that you can communicate with the pilot. My partner and I have signals for: pit stop, end of race, fly low to conserve fuel, number of laps remaining, keep going with no pit.

When the model comes in for the pit, you should be ready for it. Your equipment should be arrayed in the most advantageous way.

Break the task down into its basic elements and figure out the best sequence. You have to catch the plane, fuel it, reset the shutoff, connect the power, and flip the prop. I will illustrate by giving my own sequences for shutoff and no-shutoff planes. Yours will vary according to your situation.

First of all, I believe that on a plane with an exposed engine, using a second crew member as a battery operator is faster than worrying about getting electrical contact myself. I assume that the battery person will connect the battery and remove it: I never think about it. I just go about the job of fueling and starting and releasing the plane and ignore the electricity altogether. The battery man connects and disconnects it and checks the plug status on the meter. I feel this is at least a second or two faster than having to feel for the hot contacts and look at the meter (if the engine doesn't start first flip). With a Rat Racer, the cowling makes the hot contact necessary.

*Sample pitting sequences.* Sport Race (not shutoff or fastfill): Catch plane. Connect fuel bottle to feed tube, push button to open uniflow vent (simultaneous). Squeeze fuel bulb. Remove fuel bulb and release uniflow button. Lift nose of plane, strike prop. Release plane. During this time, the battery man has handled the electrical system. This type of pit stop should take no more than two or three seconds longer than it takes fuel to enter the tank through the restricted fuel feed line, a total of seven to ten seconds.

Super Sport/Slow Rat/Goodyear: Catch plane. Insert fuel probe into fastfill plug or device (operate uniflow button if applicable). Squeeze until overflow. Reset shutoff just before stopping squeeze (this lets a little fuel move into the lines). Remove bulb, lift nose, and strike prop. Release plane. Battery man has done his work during this time. With fastfill equipment, this should take no more than five seconds.

Rat Race: Catch plane; grip it so that you are connected with the hot contacts (If you can't do this throughout the pit stop, they're in the wrong place). Insert fuel probe into fastfill plug. Squeeze until overflow. Reset shutoff just before stopping squeeze. Lift nose of plane, strike prop, and release. This should take no more than five seconds.

Notice that none of the sequences above mention priming the engine. The most common error I have seen on the racing circles is priming of hot engines. This is almost *never* advisable and usually will flood the engine and make it impossible to start. All that is needed, 99 percent of the time, is for enough fuel to get through the lines at the end of the fueling sequence to charge the crankcase. Practice enough so that you

# duke's mixture

*Not everything we are told is so:*
*For example: We are often told "It is motor torque, and gyroscopic action, that causes an aircraft to want to turn left when power is applied."*

*I suspected these forces were insignificant, and that the spiral propwash pushing on the rudder was the overriding force at play — so I devised a little test. Take a North Pacific type rubber model. Assemble, and fly. It will fly in left turn circles. Now cement the stab in with C.A. and then extend the rudder slot from top to bottom. Put the rudder on facing down. It will fly in right turn circles. Replace the rudder with a longer parallel sheet that you can slide up or down, and you will be able to find a position where the top forces and bottom forces are balanced, and the model will fly straight. Conclusion — the "authorities" were just plain wrong.*

*A second popular belief that just isn't so: "Reducing the crankcase volume of a 2 cycle model airplane motor will improve its power." My observations didn't jibe with this theory, so I devised a test. I fitted all unported cylinder and piston into a rear cover so I could pull the piston in or out while the motor was running, thus varying the crankcase volume. Result: A very slight increase in R.P.M. as the crankcase volume was increased. This I didn't expect, so the test was repeated with several other Fox motors — and a couple of brand X motors. In every case maximum R.P.M. was achieved with somewhat greater case volume than stock. Conclusion: The "authorities" on hopping up a motor were just plain wrong.*

*A third popular fallacy is that certain imported motors are the best you can buy. Here is a simple test you can run yourself. Buy a Fox 40 Standard and a slightly more costly OS 40 F.P. Check both for ease of starting, power, idle, and throttle response. Need I tell you the results? For a back-up test, buy a Fox 50 and its more expensive imported counterpart. Perform the same tests. Conclusion — The "authorities" that tell you to buy an imported motor are just plain wrong.*

*Happy Flying,*

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know how much fuel to "gush" through after resetting the shutoff. About a half-second usually is enough.

I hope this information generates a little interest in racing or gets some of you who've been thinking about racing out onto the circle. I'm always glad to answer questions if I've left out some details.

I mentioned it before, but it's worth repeating: There are only three things standing between you and the racing winner's circle: 1) Practice, 2) Practice, 3) Practice. Oh, one more thing: More practice.

My mailbag is filling up with lots of interesting items for future columns. We'll dip into it again next month. Until then, keep writing and sending pictures, club news, etc.

John Thompson, 1505 Ash Ave., Cottage Grove, Oregon 97424. •

**Hey Kid. . . . . *Continued from page 49***

kit—don't lose it!) is better, and a three-view with photos is best. Putting what you have in a folder is a good way to present it, and plastic page protectors sold at any stationery store make it look professional.

Sometimes, however, your scale presentation can be too good. The Lacey, for instance, in real life has the lower edges of the nose box curved under and the exhausts come down through the curve. The model has them faked on a flat side. A good photo would lose you points, unless, of course, you got your documentation together *before* building the model. In this case, you'd have the only one of the six Laceys there that was correct, and you'd score over the others! Be sure and point out in writing anything that you did differently from the way it is shown on the plan or three-view. If you noticed that the Lacey photo shows no little extra stripe near the wingtip and the plan shows one, you'd better put a note on the drawing telling the judge why you left it off. Also, some planes, where there were several made, have minor differences. A photo of the plane you made is always the best way to go. By the way, expect judges to tell you what you did wrong! If you can't stand a little criticism, better stay out of contests! Personally, if I left off the far-side door outline in India ink and the judge tells me, you can bet I'll have it next time! A great way to really improve your modeling is to help judge. That way you get a close look at all the models, including your own!

**FLYING SCALE**

Even the fanciest model has to fly to be competitive. Often the guy who does the nicest model can't get it to fly right, and I have seen many a trophy go home to the guy with a mediocre model which did a mediocre flight. A Lacey built correctly should nudge a minute indoors with no sweat and do several minutes in thermals outdoors. Poorly built Laceys are still impressive flyers *if* you take the warps out of the wings and tail, balance it as shown on the plan, don't overpower it on test flights, and follow the chart which we gave you for flight trimming in the May 1988 issue of *Model Builder*. By the way, if you are just joining us, I suggest you send in for the thirteen episodes of this "getting started" se-

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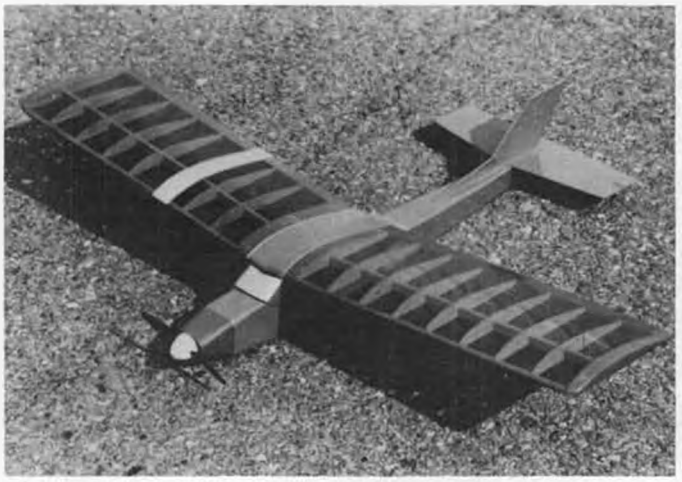

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The Astro Sport is a cute little high wing sport trainer that is specially designed for schoolyard fun. Install the Astro Cobalt 020 Motor and you have a gentle and forgiving trainer that is very easy to fly. Install the more powerful Astro Cobalt 035 and it becomes a real schoolyard show-off doing snappy rolls, loops, and other schoolyard maneuvers. The kit contains all machine cut and sanded parts and is super easy to build. Wing Span 37 inches; Wing Area 292 sq. in.; Eppler-195, Flying Weight 22 to 28 ounces. **Kit # 1019 ..... $ 39.95**

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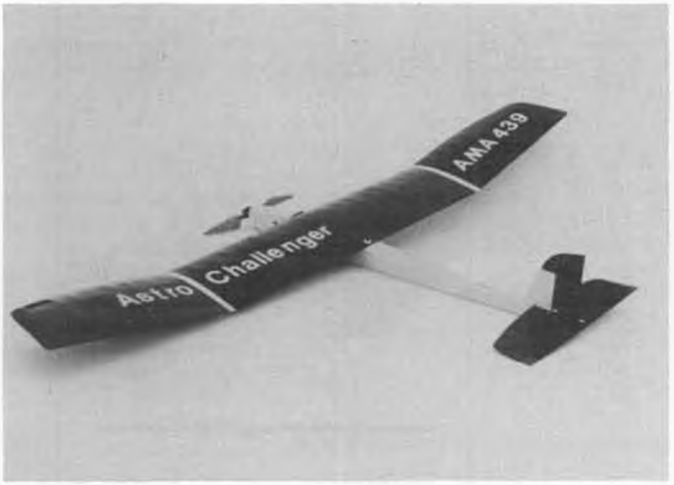
**Kit # 1013.....$89.95**




## THE ASTRO CHALLENGER NATS WINNER

Bob Boucher's Astro Challenger won the 84 Reno Nats its first time out and has been winning electric sailplane contests all over the country ever since. Powered by an Astro Cobalt 05 Geared Motor turning a 12 inch folding propeller, the Challenger climbs almost out of sight in 45 seconds, and can repeat this climb three or four times on a single battery charge. The distinctive wing planform with elliptical tips maximizes aerodynamic efficiency and minimizes tip stalls. It's gentle and forgiving nature make it perfect for beginners too. Kit features all machine cut and sanded balsa parts. Wing Span 72 inches, Wing Area 612 sq.inches, Airfoil Eppler 193 Flying weight 39 ounces. **Kit#1020..... $ 49.95**

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I would like to thank Bill Northrop for the opportunity to do this series with you, Jim Kaman for all the fantastic art work he has contributed, Peck-Polymers for their great cooperation, the Flying Aces Club for their help in keeping *real* modeling alive, all the unselfish modelers living and dead who have helped me and who have hopefully gained some measure of immortality as you carry their ideas on, and especially thanks to you for staying with us and for all those wonderful letters and words of support!

Watch for an announcement next month concerning a postal proxy meet for the Flying Aces Moth that you can enter! Fun for all who have built the FAC Moth along with us these past few months. See ya' in the funny papers. . . . •

**Simply Scale. .** *Continued from page 25*

prospect of broad television coverage. This can do nothing but help the promotion of scale and modeling in general to the public. Every opportunity we have to place our sport/hobby in the public eye in a positive manner is one more feather in our cap to help get and keep flying fields.

Best of luck to the promoters of Top Gun. If you have the time available, but haven't been fortunate enough to have been invited as a contestant, come on down to Florida in April anyway and see some great-looking scale models compete for the title of "Top Gun"!

**SMALL SCALE TRAINERS**

I recently received a letter from Terry Hreno of Mooresville, Indiana, concerning the subject of small-scale trainers. Terry is enthused about getting into R/C flying and wishes to approach it from a small scale angle. He is presently flying free flight and recognizes the requirement that in order for a small scale model to fly in a manageable manner, it must be light in weight and possess a reasonable wing loading.

He is pretty much on target in stating that there is no reason why a small scale R/C model cannot be designed with the desirable flying characteristics of a trainer. Sticking with such subjects as Cubs, Aeroncas, Pietenpols, etc. should do the job.

The only serious fly in the ointment, as I explained to Terry, is the requirement during the training phase of learning to fly R/C that the trainee receive a lot of "stick time." Remembering back some 18 years ago when I was learning to fly R/C, I can recall my attempts to learn using a Jr. Falcon powered with a Cox Golden Bee .049 engine. This was a great-flying little model, which I flew for many years, but as a trainer I discovered it had one serious fault. My instructor would launch the model and fly it up to a safe altitude for me to take over the sticks. After he handed over the transmitter, I had about two or three minutes of flying before the engine would run out of fuel and the instructor would take over control again to land it safely. This is simply not enough "stick time" to allow anyone to learn how to fly. A good trainer is usually designed with enough of a fuel capacity to allow flights in the 10- to 15-minute range.

Bottom line is, I certainly wouldn't discourage anyone from attempting the small scale approach toward learning to fly R/C, but he should realize what he's up against. The best approach toward small scale is to do your flight training on a more traditional trainer of .35 to .40 engine size, and once you're proficient, move on to satisfy your desires to fly small scale.

Keep It Scale and Simple!

Cliff Tacie, 49404 Michelle Ann Dr., Mt Clemens, Michigan 48045. •

**Insiders. . . . . .** *Continued from page 61*

"Thanks, Dave, and keep up the good work."

**WHOOPS—NO SIMPLEX PLANS**

In the item on Obscure Aircraft in the October "Insiders" we said that Al Backstrom had plans to the Simplex Racer. We goofed. To appease you, we publish the photo of this truly Obscure bird this month, with this note from Al about his plans:

"I regret that Dave Linstrum misunderstood some information I had sent him and thought that I had drawings available. Unless I am preparing articles for publication, all my model drawings are only outlines because I don't work out many of the details until I get to them.

"At this time my Arnoux-Simplex racer has been published in issue 14 of *1919-39 Air Wars*, and the stock should be in *Flying Models* this winter. Issue 15 of *Air Wars* should have the Waterman Aerobile.

"If you want to work from my outline sketches, I can send you a copy for the cost of printing and mailing.

"Al Backstrom, 1220 Yacht Club Rd., Little

Elm, Texas 75068."

## BIBLIOGRAPHY OF NFFS SYMPO REPORTS

Last year, the 20th Anniversary NFFS Symposium was published. The NFFS is publishing a sorted index of Sympo articles and their references. Twenty years of Symposia has produced so many references that finding specific information has at least become complicated and time-consuming. This book should be a useful addition to those of us who enjoy the technical side of free flight and should reduce the time required to find particular information from the Sympos.

The Bibliography includes citations of:

1. All Sympo articles published in Volumes 1 through 20 (1968 to 1987 and including the 1989 International Sympo).
2. All Sympo Model of the Year Selections.
3. All references cited in 1 and 2 above.

Each Sympo article was assigned a subject (in a few cases two subjects), and the article and all its citations were tagged with this keyword. Then the list was sorted by keyword.

Under the general category Rubber-Powered Models for example, there is Wakefield, Rubber (just the motors), and Rubber Models (all outdoor duration rubber models except Wakefield). Indoor and Scale are separate keywords, as are parts of models like Propellers and Wings.

Here are the 34 keywords: airfoils, bibliography, climb, competition, construction, electric, engines, everything, FAI Power, glide, handlaunch, indoor, large AMA Gas, Models of the Year, Nordic Glider, opinion, planforms, power models, propellers, retrieval, rocket, rubber, rubber models, rules, scale, small AMA Gas, special award, stability, structures, thermals, tow, Wakefield, weight and balance, wings.

The fully cross-referenced citations are listed alphabetically by keyword in the standard library bibliography sequence.

Using the Bibliography should allow references to be found more quickly than sorting through the Sympos one by one. Take the subject "Airfoils" for instance. There are about 100 listings under this keyword. Referring to the index allows citations to be recalled without having to flip through the 2,414 pages of the first 20 years of the best technical reference collection based on free flight.

The NFFS Bibliography is priced at $9 postage paid for members and $11 postage paid for nonmembers and all foreign addresses. Availability should be in September 1988. Order from NFFS Publications, 4858 Moorpark Avenue, San Jose, California 95129. Computer users may want to purchase the Bibliography on floppy disk. An AppleWorks data disk is available from the author, Jim Wilson, 1030 Avenue D, Redondo Beach, California 90277. Prices are $20 postage paid in North Americ.. and $25 in the rest of the world. •

**Iron Dog. . . . .** *Continued from page 53*

pick up *Model Builder*'s plan book of WWII aircraft. It should because it's a reduction (and alteration) of Clarence Mather's P-39. If you compare the two sets of plans, you'll see that the wing construction has been changed considerably and that all the wood has been appropriately "down-sized" for proper peanut construction. In addition, I chose to use a "home-brew" prop of my own design on my "Iron Dog." This is one model that won't need much nose weight; in fact, if you use a plastic prop, you may end up nose *heavy*. Mine weighed 6.5 grams (no rubber), and the CG ended up at about 10 percent (more about this later).

While not a beginner's model, construction is straightforward for anyone who has ever built a few peanuts.

### FLIGHT SURFACES

Assemble the tail feathers (5-pound, 1/20-inch stock), and build the wing "in the usual manner." I chose to use heavier 7-pound, 1/16-inch stock for the leading edge of the wing, as it does take a beating. The balance of the wing was assembled from 4- to 6-pound stock, in the sizes called for on the plans. All the curved surfaces of the flight surfaces were laminated from two pieces of 1/40-inch that were soaked, and bent around appropriately sized cardboard forms. They were then glued while still damp with white glue. If you've never used this procedure before, I urge you to try it, as it's very light and strong. I also urge you to remember to wax the forms, or you may

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**FUSELAGE**

I've had two problems with "half-shell" fuselages: Either I build 'em light (and they become crooked as the formers pull on the structure), or I build 'em straight (and they are *really* heavy). After a couple of these disheartening experiences, I resolved to find a better way. Here's how I went about it: First, strip the 1/16-inch square main longerons (use 4- to 6-pound stock for all fuselage construction). They will form the upper and lower keels of the fuselage and will also form main side stringers at points 90 degrees to the keels. Then strip a bunch of 1/32-inch by 1/20-inch auxiliary stringers. Then soak the whole works in hot water to which a splash of ammonia has been added. When the stringers are nice and floppy, pin the keels to the plan, and also pin the pieces that will become the main side stringers down to the top-view of the fuselage. This is to pre-shape the pieces, so you won't be torqueing the fuselage as you build it. Allow these parts to dry overnight, but don't remove the 1/32-inch stringers from the water—let 'em soak.

When dry, add the un-notched half-formers to the fuselage, using a small triangle to make sure they're really vertical. Allow to dry. When they've set up, add the main side stringers in this fashion: Tape a piece of carpet thread to the plan so that it will cross the tail-post where the main side stringer will. Then pull the thread across the long axis of the fuselage so that it also crosses the first former where the main side stringer should. My, what a nice straight line we've got! Tape the thread down and mark the places where it crosses the formers with a fine-tipped marker. Remove the thread, and using a *new* and *sharp* double-edged razor blade, cut notches for the former. Then remove the pre-shaped main side stringers from the plan, and glue in place. You'll note that I've marked the *approximate* locations of the smaller stringers on the formers. The only places where I found the small stringer locations to be critical were the uppermost stringer locations on formers "D" and "E." As you can see from the plans, you'll trim the tops of these bulkheads (and the upper main crutch) to locate the canopy. If you locate the top stringers as shown on the plan, you'll have a base upon which to build a floor for your cockpit. The bottom stringer location on former "E" is also important, as it will assist you in locating the wing properly. The small 1/32 x 1/20-inch stringers are (except as noted above) located by using the same procedure you used with the 1/16-inch square main side stringers except that they are installed *wet* (or damp, anyway). The trick with the string will keep them from wandering, white glue will hold 'em just fine, and they will dry in place.

If you have the same luck I did, you'll re-

move the half-fuselage from the plans and discover that no warps have been induced by stringer pull. Repeat this procedure for the other half of the fuselage. After everything has dried, you may wish to scallop the formers between the stringers (I used a small tungsten-carbide grit bit in my Dremel). This will allow you to cover the fuselage much more neatly.

**PROPELLER AND SPINNER**

The spinner was made from four criss-cross laminations of soft 1/8-inch stock, turned to shape on a Dremel tool with an emery-board.

The prop blades were cut to the shape shown on the plans from 1/64-inch ply, soaked in ammonia and water (heck, I just like the way the stuff smells!), taped to a 3-inch spray can at a 19-degree angle (the angle leans to the *left*) and allowed to dry overnight. They were then assembled to a hub made from a 1/8-inch birch dowel. To duplicate my prop, the blades should be at roughly a 30-degree angle (30.6 degrees if you're a fanatic) to the prop-shaft at a point 1-3/4 inches out from the hub. This produces a 5-inch diameter prop with a nominal pitch of 6.5 inches (P/D ratio of 1.3); conservative perhaps, but it works.

**COVERING AND FINISHING**

I covered my P-39 with Peck's Superlight white tissue, and airbrushed on two *thin* coats of clear nitrate. The insignia and numbers were cut from frisket-paper, and *thin* coats of Aerogloss Fokker Red were applied. I used alcohol to shrink the tissue on the tail feathers in an effort to avoid warps. It worked fine; the dope tightened the tissue just enough. The fuselage is covered in six sections: top left half, top right half, right side, bottom right half, bottom left half, and left side. It's a little more work, but it results in a fairly wrinkle-free fuselage.

**FINAL ASSEMBLY**

Final assembly is pretty straightforward. You'll note that the wing has about 1/16 inch positive incidence, and the horizontal stab about 1/16 inch negative. No, I'm not kidding. You may have to clip the bottom of bulkhead "E" to make it fit the wing. Make some wingsaddle mounts from light 1/32-inch stock where the wing and fuselage meet. The cockpit also requires some clipping of formers for the floor. I vacu-formed my canopy from some three-mil acetate that I picked up at a drafting supply store. Ivan, the pilot, was hacked from balsa and painted with Floquil. As always, measure and eyeball the flight surfaces carefully and make sure that everything is straight and true.

**FLIGHT ADJUSTMENTS**

Now, in the midst of all this nonsense, Doc Martin's latest newsletter happened to arrive, and in it was an article on peanut trimming by Butch Hadland. Well, since my low-wing peanuts generally have been, er, less than successful, I decided to try it his way.

The setup for the P-39 was as follows: left-left pattern, 1/8-inch left rudder, 1/8-inch wash-in on the left wing, 1/16-inch washout on the right wing, about 2 degrees right thrust, and a tad of downthrust.

The CG was located at about 12 percent with a 17-inch loop of 1/10-inch rubber installed. Yes, I know that these settings sound awfully gross for a peanut, and I know that the CG may be much more forward than what you're used to, but trust me (or Butch).

And, no, the P-39 did not fly out of my hand. I needed to remove half the downthrust—*then* it flew out of my hand. Mine will do 30 seconds *very* reliably, and I'm not even close to the 49-foot maximum of our site. It also turns nice and tight, and I believe that the ship would do well even in a small site. I suspect that better (lighter) builders than I will be able to use lighter rubber and that flight speeds will go down (and times up).

All in all, I found the Iron Dog to be a rewarding project. Give it a try and go Panzer hunting in your gym! •

**Big Birds. . . .** *Continued from page 23*

quality.

Emil's plans also reflect his ability to design airplanes that are light but not flimsy; planes that require relatively small engines and yet fly effortlessly on their wing. Here are the Spacewalker's specs: weight, 8.25 pounds; wing span, 78 inches; wing area, 1053 square inches; wing loading, 18.05 oz/sq ft; airfoil, scale 4419; engine, O.S. .46SF .61 two-cycle (comparable four-cycle).

Dry Ridge's instruction books dovetail well with their plans, so scratchbuilding wouldn't be difficult, even if you've never tried it before.

These plans, the instruction manual, and two sets of logo decals are $30 postpaid, and a glass cowl and wheelpants are available from Fiberglass Master. The address is: Dry Ridge Models, 59 McCurry Road, Weaverville, North Carolina 28787;

(704)658-2663.

**FIBERGLASS PROPS & MOUNTS**

A reminder to all who fly during the winter that fiberglass props and engine mounts are more of a hazard during the cold weather because they can become brittle and break due to vibration, causing injury to anyone in the vicinity.

Don't forget that the bottom line is: *safety*!

**1988 IMAA FLY-IN FESTIVAL**

Just got word that the 1988 Fly-In at St. Clairsville, Ohio, went well. There were over 250 pilots in attendance and they brought one helluva lot of airplanes with them.

The IMAA Directors did hold a meeting during those four days and voted on some important matters, like finally raising the dues to $15 (this will become effective next year), making the second board meeting of the year at the annual fly-in and not at Toledo, which had become a sort of tradition because IMAA was founded at the 1980 Toledo Show and because there were some problems that had to be ironed out first, and agreeing to have the 1989 IMAA Fly-In Festival at Odessa, Texas, instead of at Oshkosh (the Mecca). The Odessa people had sent a very impressive proposal package to all IMAA Directors and, hopefully, Odessa will live up to the expectations presented. We're hoping that Oshgosh will be okay for the 1990 Festival.

**BIG BIRD BASH**

The Puget Sound Rocs 6th Annual BIG Bird Bash & Tea Social was held on July 23 and 24, and once again we had outstanding weather.

We had a swell turnout of both pilots and spectators, and this year raffled off a 19-inch TV that was won by a Canadian visitor.

In keeping with IMAA rules, only door prizes and awards for being the youngest and oldest pilots and for having traveled the longest distance were handed out.

It was kinda hot on both Saturday and Sunday, but everyone had a most enjoyable time.

**THOUGHT OF THE MONTH**

This comes to us from the Brazoria County Modelers Association Newsletter.

The three most important things are: Keep It Light; Don't Build It Heavy; and It Shouldn't Weigh Much.

Al Alman, 16501-4th Avenue Court East, Spanaway, Washington 98387; (206)535-1549. Keep our outstanding safety record going, at the field and in your shop. And don't forget those cards, letters, and photos 'cause this is *your* column. •



**Electric.** . . . . . *Continued from page 34*

at 4 inches, diameter at 8 inches (the actual values used in this data), and calculate rpm. When you do, you get 11,213 rpm. The actual rpm in the data was 12,000. This is certainly close enough for our purposes, which is to get estimates.

Now that we know the method works, the world is ours! Bob Kopski mentioned in his previous columns that he likes the Astro cobalt 15 especially because it is so versatile, and can be used as anything in the 05 to 15 range. As Bob has pointed out also, the 05 etc. numbers are so vague that they are nearly worthless, so let's specify this as anything in the 90-watt (sport 05) to 250-watt (competition 15) range. For example, perhaps we want to run the 15 as a "strong" 05, about 140 watts input, on 7 sub C cells. We would like to know rpm and prop size. Let's set the current at 20 amps and assume that a 7-cell pack will be able to put 7 volts at the motor terminals. This is a very simplified picture, remember, for estimation only. In reality, the terminal voltage will be slightly lower, due to wiring losses. Anyhow, use the values of R and k we already got, and solve the "E" equation for rpm. The

numbers will be (7.0 - 3.4)/7.0 x $10^{-4}$ = 5,140 rpm. Power out will be 140 watts - (20 amps)$^2$ x .17 ohms = 72 watts. Let's choose a diameter of 11 inches and find the pitch. Set this in the "prop equation" and you get 72/746 = P x $11^4$ $5140^3$/1.4 x $10^{12}$. This gives a pitch of 6.8, or 7 inches. This is exactly what you would use for a strong 05 with a gearbox and an 11 x 7 prop. So, you can use the 15 as an 05, driving the same prop, without the need for a gearbox. Compare this to the data Bob presented in his *Model Aviation* August '88 column, which gave 5500 rpm on an 11x7 prop for a cobalt 05 with gearing drawing 21.3 amps at 6.65 volts. I find this close an agreement very impressive!

Do note how much loss there is due to the internal resistance of the 15 armature. Half the power is gone due to this; the efficiency is only (72/140) x 100 = 51.4%. This is why there are fewer turns on an 05, so the resistance losses at lower voltages will be less. A good rule of thumb is that the armature resistance should be about equal to the resistance in the battery pack. This will be approximately .012 ohms times the number of cells. Last month I ran the data for the geared cobalt 05, this gives values of .084 ohms for the 05 armature, and 8.81 x $10^{-4}$ for k. This comes close to the rule of thumb. Efficiency for the 05 with this setup is 73 percent. You may wish to set up all this as graphs. If so, the most common layouts are current, power in, power out, and efficiency as the vertical axes, rpm as the horizontal axis; or current, power, efficiency, and rpm as the vertical axes, and torque as the horizontal axis. The torque in Nm (Newtons x meters) is power out (watts) x 9.549/rpm. If you prefer inch x ounce, the conversion is 1.0 Nm = 141.6 in-oz.

You may want a more detailed "window" into the motor. If so, use the following equation for the motor at zero rpm (rotor locked): E = V(brushes) + I x R. (E = voltage at motor terminals.)

Since you can measure E at the motor terminals, and I, and you know R from the previous work, you can find the voltage drop of the brushes and therefore their resistance. However, the current values can get very high, so I suggest that you use between a quarter to a third of the voltage (cells) that the motor is rated for. The Astro 15, for example, could be safely tested with three to four cells on "locked load." An Astro 05 would be all right on two cells, and so on. Brush resistance is a good item to know; it is one of the major reasons for the jump in performance in the Astro 035.

Well enough for now! There is lots more, of course, but you have all the basics as of now to measure and predict your motor performance. Have fun! If you want a very in depth analysis of permanent magnet DC motors, I recommend the book *Permanent-Magnet and Brushless DC Motors* by T. Kenjo and S. Nagamore, published by Oxford University Press, ISBN 0-19-856214-4 hardbound, ISBN 0-19-856217-9 paperback. This book has the most information in one place that I have seen. It includes programs in Basic so you can run motor parameters on the computer. My only criticism is that often the equations get needlessly elaborate; they could have been kept simple.

Wow, have there been a lot of new products coming out in the last month! Cox has the Electric Malibu RTF plane, HiLine has their IMP 30-watt motor, Jomar has a beautiful new throttle using surface mount technology called the SM-4 and shortly will have the equivalent in the SM-5 mini for 100-watt (05) or smaller motors and will have a charger capable of charging 24-cell packs at a constant current between 3.5 to 4 amps.

I have been flying the Cox Electric Malibu, and I like it. It is a foam, ready-to-fly plane. In fact, if you have seen the Cox EZ Bee, you have seen the Malibu; the only difference is an electric motor instead of gas. The motor is small, about 020 size, and is about 40 watts input. The Malibu comes in a complete package, battery pack and charger included, with a Cox two-channel radio for a suggested retail of $333, or without the radio for a suggested retail of $216. As usual, this is often discounted quite a bit.

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The motor pack is a six-cell, 450-mAh pack; the charger is a 15-minute timer with resistor that plugs into a car cigarette lighter. I used the NorCal AccuCharger peak charger instead of the supplied charger. Flight times with this charger were in the 5- to 6-minute range. Flying weight with the Cox two-channel Cadet radio was 28 ounces. Climb was quite good; one circuit around the field gave enough altitude to clear phone poles, etc. Maximum altitude was about 400 to 500 feet. Handling characteristics were very docile; turns to the right would straighten up by themselves, and turns to the left required that you stop them with some right. The prop turns opposite to what is conventional; i.e., clockwise as seen facing the plane.

My feeling is that this plane will be very suitable for beginners; it almost flies itself. A couple of orientation flights with an instructor should get a beginner on their way quite well. It is the easiest RTF to fly that I have tested, other than the Canario, and the climb is much better than the Canario. Cox has a winner here.

My only criticisms are very inadequate wire in the harness and the glass fuse/plastic holder that has been so much trouble in every plane in which it has been used. I strongly recommend replacing the wire with good high-flex wire and the fuse with a spade lug-type of automotive fuse. You may well gain 10 percent more power, and that will give a lot more altitude and some additional duration. I recommend the plane.

HiLine is a new company to me, the address is P.O. Box 1283, Bethesda, Maryland 20817. If you send an SASE I think they will send you a catalog; they specialize in very small electric power systems. Don Srull did a very fine job on mini electrics in the September issue of *Model Aviation*, including a Dox, the 12-motored seaplane! Anyhow, HiLine's prices are *very* reasonable, you can get a kit for two mini motors with gear drive for only $12.95! You do have to rewind these motors, and the wire is provided. The motors are only 18 grams, run on three Ni-Cd cells, and can fly models up to 125 sq. in. and 4 ounces, or double that if you are flying a twin motor design. But, to the IMP 30! It is only $10.95, weighs two ounces and will fly models of up to 300 sq. in. and 10 ounces weight. It uses three Ni-Cd cells, draws ten amps, and will turn a Top Flight nylon 5x3 prop at 10,500 rpm. The motor weighs 1.9 ounces, the entire power package is 4 ounces if 275 mAh cells are used. You can buy the system which includes batteries, switch, fuse, and wire, for $26.95. I have not flown one yet, but I do have the motor, and it looks like it will perform as advertised.

Last, but not least, the Jomar SM-4 speed control is a work of art. It uses surface mount technology and is only 3/16 inch thick by 1.5 x 1.5 inches. It could easily slip into an envelope. The tiny surface mount components when seen from above look like an aerial photo of a shopping mall! Joe Utasi says that the SM-5 using surface mount technology is smaller yet! Prices on these right now are $85 for the SM-4, and $70 on the SM-5. Joe says these are the Porsche of the speed controls, and I believe it just looking at them. I am looking forward to flying mine.

For now, fly the formula for fun, fly electric! •

**Abingdon. . . .** *Continued from page 19*

storage. It is impossible to overstate the achievement of this project, and I wish Gerry and his pals lots of luck.

I would need to take up more magazine space than would be prudent to do justice to the event and the variety of models on display, but there now appears to be very few designs that escape the determined and imaginative builder's scrutiny. As fan and engine development continues, I can foresee the day when even the very early jet aircraft can be built to true scale and deliver a realistic flight profile. There were so many prototypes around there isn't space to cover them all. It was only a matter of time before somebody produced a model of the Edgely Optica ducted-prop light observation aircraft. Sure enough, this year John Wright brought along a beautifully modeled version which emulated the full-size aircraft with an extremely stable and relatively slow

flight profile. There were several other unusual models present, and Jim Harrison impressed all with his plan-built Star Cobra double delta canard model. His extremely high angle of attack approaches and even touch and goes delighted the crowd and proved the merits of true canard performance. My own flying club site is public park land, and most of my models are unsuitable for small field operation. This model and several others opened up the possibilities for this situation.

Reg Smith, who fully recovered from the loss of his magnificent TSR2 at Swinderby, brought his MiG 25 and Crusader along. The MiG's performance last year was slightly marginal unless the engines were on song. His efforts at Swinderby showed some improvement; Reg excelled himself at this year's Abingdon event with a spirited takeoff and a very sprightly performance. The thrust improvement was so noticeable that I thought Reg had replaced his O.S. 46s with larger engines. Not so! Reg informed me that he was using the new Thorpe fan units. Peter and Paul produced 65- to 80-size fans for their very successful Thorjet units. The shroud is common to all three engine sizes, the fans having a common diameter. They have developed the 5-blade 45-size fan and produced a 60- to 65-size 7-blade unit and a 80 to 90 9-blade version. The interesting point regarding Reg Smith's application was the marrying of the O.S. 46 to the seven-blade fan. The improvement in thrust, although not measured, was evident. The O.S. engines appeared to be in no way overloaded and possessed that comforting healthy purity of sound that comes from the 22,000 plus rev range that means optimum thrust.

Flight line discipline was of the highest order. Anybody stepping on the runway without a model or transmitter was pounced on and escorted back to the grass dispersal. Safety is all-important on these occasions to preserve our past safety record and ensure future opportunities to use this superb and by now traditional venue for the oldest and we "Brits" still believe the best fan meeting in the world.

I leave you with the photographic record which says far more than the text. •



**ARFs.** . . . . . *Continued from page 37*

built by the pilot, borrowed from a friend, or a prefab job flown right out of the box. The rules are simple and should be kept so, as constant rule changing leads only to confusion. And, of course, you can choose from many ARFs on the market if you don't feel like constructing a traditional model. But remember, above all, the main objective is to have fun!

**MAILBAG**

This month's mailbag produced an interesting letter which posed some very intriguing questions. Frank Palermo, of Tulsa, Oklahoma, asks for information which may prove to be of benefit to our general readership, so here is what he writes:

"I have had some experience with R/C cars, but for years I have been wanting to take up flying R/C airplanes. I have good coordination and manual dexterity, but I just don't have the time or inclination to build models. Before reading your excellent columns, I had been under the impression that ARFs are not really suitable as trainers, so up until now I have been sitting on the sidelines. Now I realize that there are a number of good trainers I can buy which will get me into the air with a minimum of work, so I am now ready to take a crack at R/C flying.

"I would like to ask you for a specific recommendation as to what trainer to buy, but I realize you probably would rather not like to try picking one plane out as being best for me. However, I know you have advised that a good trainer should be a big, slow-flying model with a large wingspan, plenty of wing area, and a light wing loading. Of all the ARF trainers being made today, which one would you say best fulfills the requirements you have stipulated?

"Many thanks for your fine articles. You can be sure you have acquired a devoted reader." Thanks for not putting me on the spot by demanding a recommendation for the best ARF trainer available, as I really don't think I am prepared to answer such a question. But you do ask for some specific information, and this is something I can






easily give you. However, before I do, I want to thank Frank for his letter, as it certainly backs up my belief that the myriad of ARFs available on today's market is having the effect of drawing new people into our R/C sport/hobby. These new devotees are people who would have taken up another pastime if getting into R/C flying was only made possible by building a conventional model.

Now, Frank wants to know what ARF trainer offers the biggest wingspan, largest wing area, and lowest wing loading. Fortunately, extensive personal research has empowered me to supply you with this precise information. To the best of my knowledge, the ARF trainer which best personifies the attributes you desire is the Thunder Tiger Skylark 40T as imported by Global Hobby Distributors and available at most hobby shops.

As a trainer, this model has a lot going for it. It has a high wing with a flat-bottomed airfoil, which is such a great asset in a novice-type plane, and a tricycle landing gear, which contributes to optimum ground handling. The wingspan is a whopping 68.6 inches, wing area is 736 square inches, and wing loading with a 5-pound flying weight figures out at about 15.6 ounces per square foot, which places the Skylark 40T squarely in the floater category. The 40T is supplied fully built, sanded, and covered with a heat-shrink plastic film in a high visibility color scheme. Recommended engine size is .35 to .45, so a good .40 two-stroke engine should prove ideal. The manufacturer indicates that four-channel operation is required, but I see no reason why aileron operation would be necessary in the basic training stage. I'm sure that the ailerons could be easily immobilized should three-channel operation be desired. Be sure you get the 40T. There is a 40H which is similar, but for more advanced beginners. This aircraft has a semi-symmetrical airfoil and less wing area.

At this point I would like to make it clear that I have not personally flight-tested the Skylark 40T, but I have seen it flown by others. It appeared to be a winner to me. To really gild the lily, the price of this trainer is only $99.99! Don't forget, this includes all hardware, wheels, and fuel tank. All you need supply is engine and radio.

Before concluding, I want to serious warn you not to attempt to teach yourself how to fly R/C. In spite of what you may have read or heard, this is almost impossible for most people. Find yourself a competent instructor, because if you don't, your chances of wrecking your plane and injuring yourself or some innocent bystander are much too high to risk.

Questions, comments, and inquiries of all kinds pertaining to ARFs are welcome and encouraged. I pledge to personally answer each and every letter (an SASE would be appreciated), and whenever space permits we will publish those of general interest. Write me at 2267 Alta Vista Drive, Vista, California 92084; (619)726-6636. Thanks for your help in getting this crate of a column off the ground. Now that we've made our last landing for the day, we'll roll her into the hangar and see you again next month. •

**Free Flight. . . .** *Continued from page 59*

forthcoming in Pond's column as well as in this column; perhaps even next month, so stay tuned.

**THE HONG KONG EXPERIENCE**

Last month, I noted that I would be taking a vacation trip to Hong Kong. I posed the question, is there free flight in Hong Kong? Well, I am here to tell you that if free flight exists in Hong Kong, I wasn't able to find it. Additionally, although about 25 hobby shops are listed in the telephone directory, I was only able to locate two of them. One specialized in radio-controlled cars only and was staffed by two people, neither of whom spoke enough English to assist me with finding a shop that might know about free flight. (Just how do you say "free flight" in Chinese anyhow?) The other was a more general-purpose hobby shop, featuring not only R/C cars but other radio-controlled models as well. Japanese R/C engines were for sale for reasonable process and nearly all of the equipment featured was of the ARF variety. No free flight building or flight items, such as real Japanese tissue, engine timers, and the like were available.

I did embark on a hunt to find the Hong Kong Model Supply Co., Ltd. This company, which is one of the oldest and most established outfits in the country, had just moved to a new location a few months before we arrived. The new location was posted in the shop that occupied the building. I followed the directions to the new location, close to the waterfront docks, where the only language that was spoken by the people we attempted to talk to was Chinese. It was a fruitless search, and one that might have been more successful if the street addresses were in English. Needless to say, it was a disappointing venture.

Hong Kong itself is a delight to visit, but if the hobby industry is alive and well, you can't prove it by me.

**GOLLYWOCKS GALORE!**

Recently, I received a letter from Tom Hepler of MACH (Model Airplane Club of Huntsville). Tom sent along some pictures

# New Cox Electric Malibu

## Electric ARF* Never Flew Better

If you're like many R/C pilots, you'd like the convenience of an electric ARF . . . spend an hour assembling, go to the nearest schoolyard, flip a switch and you're in the air . . . But you're worried an electric airplane won't meet your performance expectations. So depend on the model airplane company you can trust. Fly the Cox Electric Malibu, because with it, electric ARF never flew better.

The Electric Malibu's maneuverability provides fun flights for the most experienced pilots, and it's so stable beginners fly successfully. The secret to this superior performance is maximum thrust and minimum weight – a powerful Mabuchi RK-370 motor and a lightweight airframe. Add the huge 52" glider-style, polyhedral wing and the Electric Malibu has the speed, lift and stability to climb hundreds of feet.

Because it's a true ARF and not a kit, the Electric Malibu assembles quickly – in about one hour. And your purchase is convenient and less expensive because everything you need is in one package: electric motor, nickel cadmium battery pack, quick charger and with or without Cadet two-channel radio.

But best of all, the quiet electric motor won't disturb neighbors, so you can fly at any nearby large field.

So have fun with the convenient ARF that flies great. Ask your local hobby retailer for the new Cox Electric Malibu.

*Almost Ready To Fly

COX

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1525 E. Warner Ave.
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of the boys who were flying the event. The idea was for everyone to show up with Gollywocks and enter in a mass-flyoff; kind of a gaggle of Gollywocks. Merchandise was obtained from Midwest, who once produced the Gollywock kits. Carl Loehle did the organizing and sponsorship. Site was the Old Huntsville airport. The event was so popular that it is intended to be held at future MACH meets.

Incidentally, I recently was informed by the self-appointed local free flight design historian, Phil Hainer Sr., that the Gollywock that was published in *Air Trails* in the early 1940s was incorrectly presented. Errors in wing and stabilizer rib patterns and wing and stab chords were erroneously printed. Phil has produced a correct set of the three-views, and even though this design more properly fits within the realm of John Pond's column, I intend to print the revised and corrected three-view in either the January or February issue of *Model Builder* "Free Flight." You can't say you haven't been warned.

**TURN ON THE BUBBLE MACHINE**

Abram Van Dover reports in the *Brainbuster* newsletter that a bubble machine is available from K-Mart stores for a mere $7.78 plus or minus a dime. This news, reported by Kay Fags, indicates that once you take all of the Kiddie Junk off the machine, it will fit into a small box. It also spouts all kinds of bubbles, so that finding the elusive thermal should be child's play. That's a pun, son.

**AND SPEAKING OF PUNS**

A witch doctor told one of his patients that the cure for his stomach ache was to take a thin strip of leather, cut it into 12 equal pieces, and swallow one each day.

After the twelfth day, the patient returned to announce, "It's no use, Doc. The thong is gone, but the malady lingers on."

**THE END OF DECEMBER**

I know this really gets confusing. As I am finishing this column, it is about 90 degrees outside on this late August day. I know that the December issue of *Model Builder* actually arrives in the mailbox or on the newsstand in late October or early November. What's a columnist to do? I could rail on about the AMA Nats cancellation of outdoor free flight, but I've done that already, and the free flight newsletters are doing a bang up job on this topic anyhow. So, rather than ramble on about wintertime, I'll just sign off for now. Thermals to all! •

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**Hannan. . . . . *Continued from page 51***

upon the *Americana* section, in itself an unusual placement for our hobby, which featured an exceptionally perceptive article by Daniel Kagan, "Winning on a Wing and a Prayer." (Yes, *Prayer*; that spelling is as intended.) The Nationals model meet was examined in surprisingly thorough and favorable fashion, seldom seen in general-audience publications.

The "playing with toys" image, often implied by some reporters, was conclusively dismissed with: "These aircraft require copious engineering skill and artistic creativity," and a quotation from 56-year-old Jack Fox: "This is the largest R and D bunch in the world." And how about this for concise summary of indoor microfilm modeling: "It requires the patience of a saint, the dexterity of a brain surgeon, and the eye of a watchmaker."

**VELCRO MODELS?**

Frank Zaic sent an article about George de Mestral, the Swiss inventor of Velcro, the material used as a fastener for many types of clothing, etc. What caught Zaic's attention was a tiny reference to de Mestral's first patented invention, a toy airplane. Does anyone in our audience know of it?

**BOOK REVIEWS**

New from Bertram Pond is *Expansion Engine Powered Model Aircraft*, a comprehensive review of compressed-air powerplants and their models. $CO_2$ and steam are also mentioned to a lesser degree. The terms "engine" and "motor" are used variously throughout the book, so take your choice. Thoroughly examined are historical development, materials, fabrication (powerplants *and* model aircraft), safety factors, accessories, and much more. Weight reduction methods without structural strength sacrifices are presented which have direct application to *any* sort of flying model, not just expansion engine types.

The real frosting on the cake for this reviewer were the dozens of construction plans, patent drawings, and early engine advertisements, some dating back to before World War I. Priced at $17.95 plus $2.60 for

postage, handling, and insurance, the book may be ordered directly from: Bert Pond, 128 Warren Terrace, Longmeadow, Massachusetts 01106.

***WALDO***

Written by the late Waldo Waterman with Jack Carpenter, we found this to be a truly engrossing book. Waterman was a pioneer aviator (he flew a hang-glider during 1909), barnstormer, inventor, aircraft designer, manufacturer, airline pilot, airport manager, and test pilot all in one lifetime! Among his aviator acquaintances were Glenn Curtiss, Lincoln Beachey, T. Claude Ryan, Tony Fokker, Bill Stout, Igor Sikorsky, Alexander Seversky, Charles Lindburgh, Amelia Earhart, Roscoe Turner, Frank Hawks, Tex Rankin, and well, you get the idea.

Waterman was also involved in show business, actually appearing in some movies and assisting with others, including Howard Hughes's classic *Hell's Angels*. Thus his contact with personalities such as Clara Bow, Norma Shearer, Alice Faye, Will Rogers, Wallace Beery, Hoot Gibson, and many more.

Waldo designed numerous aircraft, including one which remains a favorite among model builders, the Waterman Gosling racer (a three-view of it appears in the book). Other less-known subjects include his "Whatsit" canard, and the "Flexwing," which had shock-absorber-mounted wings permitting automatic changes in dihedral (a "natural" for a free flight scale?).

Waterman's series of flying wings and roadable aircraft are thoroughly described and sorted out, starting with the Arrowplane, followed by the Studebaker-powered Arrowbiles, and concluding with the Aerobile, which featured an ex-Tucker automobile engine (which was, of course, a converted aircraft engine!).

The book is a gold mine of incidental aviation information, such as confirmation of the fact that the early pilot licences *supposedly* signed by Orville Wright, were actually rubber-stamped by a man named Bill Enghart. Apart from aviation, Waldo was strongly interested in yachting, and among those who crewed aboard his "Lady Godiva" was Dennis Conner, now skipper of the *Stars & Stripes* America's Cup defender.

*Waldo* is published by Arsdalen, Bosh & Co., Box F, Carlisle, Massachusetts 01741, where ordering information may be obtained. Please tell 'em *MB* sent you!

**SPEAKING OF THE STARS & STRIPES**

One of the Stars & Stripes catamarans incorporates a carbon/composite vertical surface, rather than a conventional fabric sail. What has this to do with aviation? Everything. The aerodynamic surface was produced in Mojave, California, by Burt Rutan and crew!

**PIPPI LONGSTOCKINGS FALLS SHORT**

In earlier columns we mentioned the movie *The New Adventures of Pippi Longstockings*, in which a Pitcairn PCA-2 Autogiro took part. We have finally seen the production, and received reports from several other people who have also. Although a few enjoyed the film, most felt it quite disappointing. In spite of having an accomplished team, talented actors, clever "props," and good camera work, the end result was underwhelming, to put it tactfully.

Still, if you are an Autogiro enthusiast, you might feel it worth attending to see Steve Pitcairn's wonderful "Miss Champion" in action. We were also pleased to see a proper screen credit for George Towson, who restored the 1931 Autogiro to flying condition.

**MUSEUM OF FLIGHT**

Any readers who may chance to visit the Seattle, Washington, area are urged to visit the Museum of Flight. This splendid facility displays an amazing selection of full-size and model aircraft and memorabilia. Thanks to Bill Pinkston, who has several examples of his work in the collection, we were able to tour the place and meet 'curator Vic Seely. And yes, he too is a model builder!

The museum is adjacent to an airport bustling with activity. While we were there, a brand new Boeing 747-400 with winglets was undergoing flight tests. And while you're in the neighborhood, about a 30-mile drive will take you to the factory where the 747s are manufactured in the world's largest, by volume, building. Now, if only we could move all those Boeings out of there, what an indoor flying site we'd have!

**MODELERS ARE THE GREATEST**

Sometimes readers seem to have the impression that all of *Model Builder*'s contributors work in the same office, or at least see each other frequently. Such is not the case; the vast majority of our correspon-

dence with them and other modelers is via mail. Thus, face-to-face meetings or even telephone calls are privileged and educational experiences. Among those we've visited with recently are Dave "Mr. Insiders" Linstrum, of Florida, and Jose Tellez; Mr. and Mrs. Bob Stalick, Lew Gitlow, Andy Tagliafico and son, of Oregon; aviation book collector Dick Seely, of Washington; Mr. and Mrs. Benno Sabel, of Germany; Mr. and Mrs. Fritz Mueller, of Georgia; and Rune Johansson, of Sweden. Marvelous people, all of them, reminding us of the most important bonus in this hobby of ours, the bonds of friendship.

**SIGN-OFF**

Ed Whitten favored us with this 1896 poem by Emily Dickinson:

"We never know how high we are
till we are called to rise
And then, if we are true to plan
Our statures touch the skies." •

**Tucano.....** *Continued from page 35*

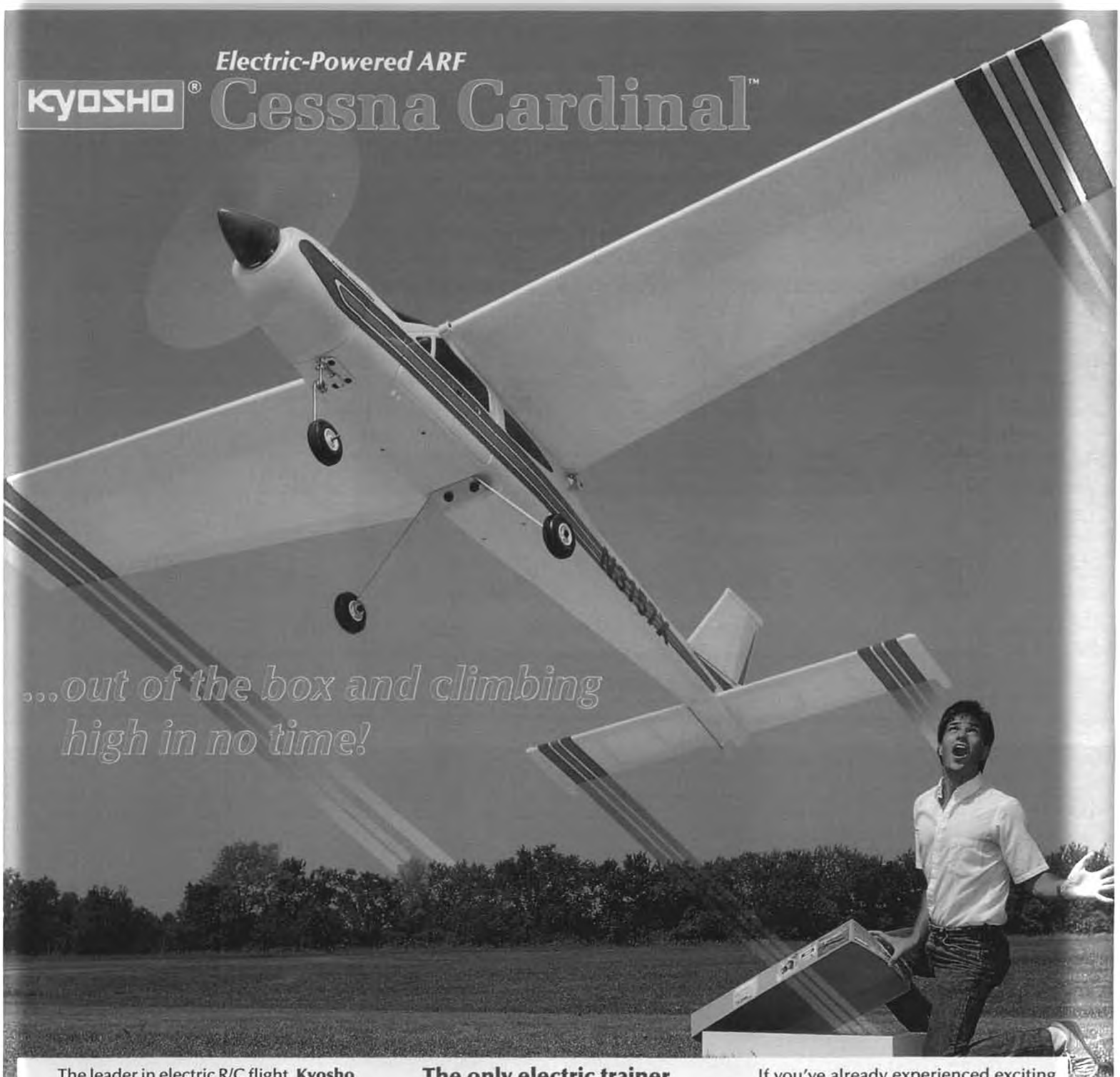
urethane paint. It comes with the wing joined, all control surfaces hinged, pushrods made, fuel tank installed, and really very little required before you have a completely ready-to-fly airplane. Obviously, it will need a four-channel R/C system, and a .40 to .45 displacement engine is recommended. The only other items you'll have to furnish are a prop of the correct size, and a 2-1/4-inch spinner. Oh, yes, and some fuel! Disliking empty cockpits almost as much as I do uncowled engines and boxes with absolutely no similarity to full-sized airplanes, I added a couple of Williams Brothers pilots.

Even servo mounts are provided, an all-plywood design which adjusts so as to accept most of the medium-size servos of the size that you would want to use in a model of this size. The engine mount furnished is also adjustable and will be adequate for most .40s. However, my choice of the Picco .45 as a powerplant necessitated the removal of the original mount and its replacement with a Hayes mount of slightly wider beam dimensions. The cowling itself is quite adequate for the Picco and similar-sized engines and required only needle valve and exhaust access openings to be made.

Your Tucano will come with the horizontal stab removed; it is attached with a couple of sheet metal screws into a 3/16-inch plywood base. Since I don't plan to disassemble mine for any reason, I decided I wanted the security of some epoxy in addition to the screws. After first removing all paint from the mating surfaces, I joined them with slow-drying epoxy, using enough of it so that it would ooze outside. The excess is wiped off with an alcohol-moistened rag, leaving a nice invisible bead within the joint for complete fuel proofing of this critical area. While I was back there, I also installed a Goldberg nylon skid, just in case.

The fuselage is quite roomy, even having room for a larger fuel tank if you so desire. Since the .45 would naturally be a little more thirsty than the smaller engines, I did make this change. In any event, I would change the original fuel tubing, which is opaque, with one of the clear varieties, as it always helps to see the action during refueling and when trying to start.

Another improvement I feel is necessary is to the wing mounting system. It is held in place with commonly used 1/4-inch machine screws, two in front and two in the rear. Incidentally, there are really nice aluminum screws with large diameter thick heads, and a very accurately machine-cut thread, not a rolled thread as is most often seen. Anyway, these screws go into a threaded plywood crosspiece, in which I feel the thread is going to weaken after repeated assemblings. The threaded area can be greatly strengthened by applying slow-hardening epoxy to the inside of the threads, working it in thoroughly with a small-bladed screwdriver. The screws are then installed, after first applying a thin coat of Vaseline to the threads, to keep the epoxy from bonding. After the epoxy has set—tomorrow sometime—you'll have a perfectly formed thread that is never going to let you down, in any fashion. The idea being the use of the "tomorrow sometime" type of epoxy is that penetrates into the wood much better than the faster-setting formulas.




The leader in electric R/C flight, **Kyosho** has taken the lid off superior electric performance and opened a whole new world of flying satisfaction to beginning pilots.

With a pre-built design and easy flying qualities, Kyosho's new 1/9 scale electric **Cessna Cardinal** will be out of the box and flying high in no time! You simply can't make building mistakes when so much of the assembly has already been done for you. The pre-built design also means that the Cardinal is *strong*. The special blow-molded fuselage provides incredible strength, and the balsa-ribbed wing and tail are pre-covered with a resilient polyester film. In just one evening, you can have the Cardinal flight-ready, and because it's built for survival, the plane will be soaring long after the training flights have ended.

## The only electric trainer combining fast assembly with flying simplicity.

The high wing design of the 47" span Cardinal gives it the smooth and stable flying qualities needed for easy beginning flights. It's also virtually impossible to stall, and with the included electric motor and matched prop, you'll have enough power for off-the-ground launches. Take a spare 6-cell battery with you to the field, and you can enjoy practically nonstop piloting with effortless replacement of the used pack.

Kyosho has put its expertise in electrics to work in the new Cessna Cardinal, resulting in a unique ARF that's durable, easy to fly, and above all else, lots of flying fun. Out of the box, it's magic.

If you've already experienced exciting gas-powered model flights, you'll love the Cessna Cardinal. It goes together fast, is great fun to fly, and provides a thrilling transition from gas to electric flying.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*For an inside look at the hottest Kyosho R/C models, send to the address above for your free copy of the Kyosho Mini Catalog from Great Planes.*

As you might expect, a model of this type does not require a whole lot in the way of instructions, and does not come with a lot. My major disagreement with them involves more a matter of flying technique than anything else. They recommend a lot more control surface throw than I normally use. This is because I am not impressed with how rapidly a model can be flown through a maneuver, but more by how smoothly and realistically it is done. Actually, in the case of a center of gravity at the rearmost indicated position, an elevator throw of 1/2 inch up and down, as recommended, could easily get you in trouble. I am flying with about 2/3 of the recommended throws, with the dual rates set even lower.

On the subject of the CG, the range is clearly *painted* on the side of the fuselage. I recommend the forward point, which, even with the larger Picco up front, required a little help in order to get there. Simple. Requiring only the addition of one of Prather Products' prop shaft-mounted nose weights. I don't believe this is a commonly known item; they are heavy circular pieces which replace the prop washer and fit inside most spinners, being held in place by the prop nut. They come in weights of 1/2, 1, 1-1/2, and 2 ounces, and being right out there in front will have more effect than the same amount of weight further back in the cowling. If your hobby shop does not stock them, add some on your next order to Ace R/C.

We are almost ready for that all-nerves first flight. All that is lacking is one more control check: left stick, left aileron up, right aileron down; back stick, up elevator, etc. Now we are ready! The Tucano is fast, with crisp response to all controls. As with all airplanes of this general configuration, size, and weight, one could get in trouble with too little speed and the wrong attitude; but under normal flight conditions, the Tucano does not have any unpleasant characteristics at all. Due to the shape of the fuselage, it appears to fly nose down, as if it is digging to get ahead. With the controls slowed down as mentioned, landings are a cinch, though it would be wise to remember that this type of design is not exactly a floater but needs to be flown in, as is the full-scale, with safe flying speed until the moment of flare and touchdown. The Picco has not given me the chance to try a "dead stick" landing, so I can't report on that, but a couple of simulated full-idle approaches have been made without problems, again remembering the basics of nose down and airspeed up.

Talking about the Picco .45, it is one of a family of Italian-made engines available in sizes from .21 to .90, and in car, airplane (both propeller and ducted fan), and marine versions. It is a robust-appearing engine, with modern design features such as Schneurle porting and ball bearing-supported crankshaft. The one unique feature of this engine is the round exhaust fitting, common in rear-exhaust engines but not so in side port models such as this one. A bolt-on muffler to match is available, so the uncommon opening is not an inconvenience

in the least and will actually make life easier if a tuned pipe is to be added. Piccos are available here in the US from Andes Hobbies, P.O. Box 3077, Laguna Hills, California 92654; (714)582-5203.

The other faithful member of this team has been the Futaba Conquest PCM mentioned earlier. There are other R/C systems that I would choose for certain specialized applications, but for general flying, this is my first choice. It does not have a lot of extra features which I don't use, don't need, and which could get me in trouble somewhere along the line. However, it does have five channels, servo reversing, dual rates on elevator and ailerons, modern design, and the kind of reliability that I used to dream about back when I was fixing Orbits! Besides, it is inexpensive. Not cheap, just inexpensive!

The Tucano is extremely nice to look at and a challenging, though safe, experience in the air. And it didn't take a lot of time to get it up there. Yours is now waiting in Miami at Air Champ Models, Inc., 2854 NW 79th Ave., 33122; (305)594-5616. You may opt to wait for a version in military camouflage or a slightly larger one for .60 engines, both which I understand are somewhere between here and Brazil. But don't wait too long, you'll miss out on a lot of good flying. •

**Engines.** . . . . . *Continued from page 38*

of control line scale will ever be lost by the Soviets.

For the sake of simplicity through the past years, I've shortened the engine's name in correspondence to KK-Zap 10. Boris Krasnorutskij is known to be the prime person behind the engine and much of the mechanics of the winning model. This team even made their own engines for their 1972 team race win, so the success of the KK-Zap 10 engines was no fluke. There are conflicting stories about where the 11 engines have been made. The Tula district of the Soviet Union has been mentioned twice. I've also been told on good authority the machining of the 11 engines was actually done in the maintenance shops of the Soviet's Air Force near Kiev and that the time spent in 1978/79 may have cost Boris Karsnorutskij a rather prestigious job as a teacher of incoming machinist students.

There was also a patternmaker involved who we'll call Ivan. Before castings are poured from molten metal, there are usually conceptual drawings; true engineering drawings are then completed. Next, wood patterns are made from the final drawings so that special tamping sand cavities can be prepared to receive the molten aluminum alloy. The patterns are used over and over, and the entire process is called *sand casting*. The process lends itself to small-volume production, such as 11 engines. My engine came from Ivan, the patternmaker who is not a model builder. It *has not been mounted or run; it is a pristine, brand new KK-Zap 10* that was apparently given to Ivan for making the patterns. It's probably the only *new* one in the world.

One of the original five engines was taken to Japan in 1974 by Nat Polk for copying. This resulted in the Hiness Arrow .60 engine story that appeared in *MB*'s May 1988 issue. Frank Kramer of Pennsylvania wrote me of the Arrow. "I had one of the first (Arrows) to arrive in this country, and it was so bad I never got it to run." Like me, Frank was hot on the trail of owning a KK-Zap 10 too. He succeeded in also getting a new, unrun one from the second batch of six almost two years ago and ran it for the following neat report:

"I ran the KK-Zap 10 and the day was in the lower 60-degree range with 40-percent humidity. It started up instantly on an assist from a Royal starter. I used a homemade connector to hook Ni-Cds to both plugs and a Royal Digital Tachometer for readings. Prop was 11 x 7 Master Airscrew; Red Max 10-percent nitro fuel; two Fox long idle bar plugs. Full throttle rpm was 12,200 and the idle was safe and steady at 2500. The throttle range was really linear, and engine's response was very immediate even after idling for a minute or so. Vibration was nonexisting (virtually) and the engine ran very smooth and steady. It really barks a sweet song." I urged Frank to not lessen the collectible value of his rarity by running it, but he runs them *all*, so we're grateful for his report. Frank's engine still has a high-dollar value today!

In the Hiness Arrow story I mentioned I needed help, that I finally owned a KK-Zap 10, but it was in the Soviet Union with Nikita, and he was trying to find a willing person to bring it out past border guards from the Kiev area. Soviet citizens don't yet have the simple freedom of going to a post office and mailing a box with a model engine to the USA. *MB* reader Tom Dixon in Atlanta (imports special stunt Merco engines to the USA) fired back a letter suggesting I contact certain American modelers who were going to the 1988 World Control Line Champs *in* Kiev right after the USA Nats. The first modeler contacted does "sensitive" government work and his wife wouldn't hear of taking any risk over a model engine. Meanwhile my KK-Zap 10 left the patternmaker in the Soviet Union by a Czechoslovak worker who had been on a Soviet assignment. That was a crucial exit. It was handed over to, in Czechoslovakia, a most-trusted modeler friend of mine. It was physically "From Russia with Love"! But mailing problems *still* existed for this treasure of the world. It was then taken from Czechoslovakia *into Poland* to a model contest where it was passed to another most-trusted modeler friend of mine who lives in Poland. And the Polish pal was already on his country's FAI U-Control team destined to go to the 1988 World Champs in Kiev, Russia; right back where we started!

While all the above intrigue and actual risk was taking place behind the Iron Curtain, there was more engine sleuthing starting in Moscow that I hadn't yet heard about. Please remember that Krasnorutskij taught machining, according to one reliable source. One of his star students was named Mikhail, of Moscow. Mikhail was so inspired by his teacher, he started making inline model engines from barstock, totally magnificent shiny jewel-like model engines I.D.'d only as RBS-10 engines. Then a letter arrives from Stanislav saying two RBS-10 engines are fitting into the plot, and there's triple importance to the "operative" I appoint for the pickup because the "package" will include a sand-cast original KK-Zap 10 (it's highly unlikely more will ever get made) and *two* RBS-10s, which will hopefully be sold in the USA so I can buy needed R/C

equipment and other "goodies" to get smuggled back through the network of operatives to waiting model builders. Meanwhile a letter arrives from Mockba (Moscow) with three initials that translate to IBM. It says:

"I always enjoy your articles on engines in *MB*; especially when you cover diesels or Soviet engines. The May issue was quite interesting, as I didn't know such an engine had been made in the Soviet Union. You note that you could use help in getting yours home. I currently reside in the Soviet Union and might be able to help you out. I would prefer to do it discreetly, as I'm not even sure where my friends are located in this country. A model engine can't be super-sensitive technology. I'm forbidden to use my R/C aircraft even though I've converted to 27 MHz. Drop me a line at the above address and it will find its way to Moscow and me. I will come up with a way for your engine to get to me and ultimately (though quietly) to you." With Tom Dixon's help I'd already located a "prime operative" on the USA team going to the Kiev World Champs, and now I had a "reserve operative" in Moscow who works for IBM and reads *MB*. I felt as secure and comfortable as "007" in bed with a blonde. The Polish pal successfully made the transfer to the American team member in Kiev. Maybe I'll be able to show you the RBS insides and outer glitters in the future. And that's the true thrilling tale of how my KK-Zap 10 and the two RBSs got to my bank vault here in the USA.

A technical description translation says: To the engine delicacy belongs a Russian-built linear 10cc ABC glow plug engine with valve drum suction. Very short crankshaft rotates in two ball bearings. One set is at the end of the shaft in a separate side lid, and the other is in the crankcase between a skew-toothed wheel and a flywheel. By means of the second wheel (gear ratio 1:1) the crankshaft motion is transmitted onto the second shaft placed in separate bearings. The latter one is attached to the bottom of the housing parallel to the cylinder axis. The drum valve driven by a connecting rod pin rotates in another side lid. Suction tube with R/C carb is bolted to the lid which continues backwards just along the longitudinal cylinder fins and cylinder head with two plugs. Top power is about 1.1 Kw on FAI fuel. With the full-scale three-bladed prop 280/160 (about 11-6), it turns near 11,00 rpm.

Then I got an interview with Boris Krasnorutskij translated to English with the help of *MB* reader Stasha Kulagin and his brother Kornily, of Anchor Point, Alaska. The meaty and best parts follow for your pleasure:

"The World Champs of modeling is held every two years. The debut of the Soviet models was in 1972; our team took second place. Learning lessons from this contest, we began preparing for the future upon returning home. It was necessary to pick a scale plane to model, with two engines, classic with a new support, and rich documentation of drawings and pictures of a truly modern active aircraft; the choice was the Antonov AN-14M. I had a hand in creating this actual full-size plane in the engineering drawing works. To copy the design as completely as possible, we decided to make *special engines* of 10cc each. Their uniqueness was placements of geniculate crank and a shell with a piston on a single crankrod. The engine turned out compact and the diameter was 50mm. We built five engines; one was run for eight hours and duration-tested for failures, faults, and defects. None were found. For the model we built a programmable mechanism activated by one supplementary on-board battery. Other controls were activated from the flying handle. Controls were made for engine speed control, braking, actuating the undercarriage, actuating the engines' cooling louvres, the hatches, and dropping of parachutists in flight, along with other scale functions." This was a complete and decided Soviet victory that owed much to the unique success of the Krasnoritskij-engineered .60-size engines.

The engines get 10 points for design excellence, 10 points for manufacturing excellence, and 10 points for performance; a perfect 30-point score. Although the castings have many tiny "blow holes" in them, they do not detract from manufacturing excellence.

If you would like a free photocopy of a very poor (and illegal) Soviet photocopy of Krasnorutskij's conceptual engineering drawing, send me a stamped, self-addressed envelope c/o *MB*'s office. •

**Electronics. . .** *Continued from page 28*

sometime during the past year, I believe, that you pointed out that Radio Shack has discontinued its panel ammeters. (Sometimes I think that they are going out of the small parts business altogether.) Anyway, I was looking for a meter recently that would read 0-1000 mA. It's hard to believe how difficult it is to find such a thing. The only thing my local electronics store could offer was a "good" analog meter in the $50 to $60 price range, which was ridiculous and something far better than I had any need for. Well, Radio Shack still sells a 15-volt DC meter for $7.95 (270-1754). It missed the index on the current catalog but is on page 132. After examining it, I am certain that it is the same meter as the 1 mA meter they discontinued except for the nameplate and scale. I hope you will agree. To begin with, it has the same internal resistance, 85 ohms, as the old 1 mA meter. Also, it comes with a 15K resistor that must be wired in series before use. Current for full-scale deflection is therefore: 15 Volts/15085 Ohms = .00099 Amps (1 mA). (It would have been simpler to simply ignore the internal resistance.)

"Although I wanted a 1000 mA meter, I decided to compromise and set it up for 1500 mA rather than try to change the scale, which would have been a big mess. To do this, the ratio of the series resistor to a shunt resistor would have to be 1500-1/1, or 1500 for practical purposes. The smallest resistor I could find for the shunt was .1 ohm in a two-watt package (1 watt would have been plenty). This meant that the series resistor would have to be 1500 x .1, or 150 ohms,

less the internal resistance of 85 equals a series resistance of 65 ohms. A 62 or 68 would be pretty close, but I wanted to get it right so I installed a 100-ohm 15-turn square pot from Digi-Key (CEG12) on the back of the meter with some two-sided sticky tape. There is a small protrusion on the back of the meter which can be cut off with a knife to make room for the pot. The center terminal of the pot is soldered to the positive terminal of the meter, and the positive terminal to the meter is soldered to one of the other pot terminals, depending on which way you want the meter to move when you move the pot. I like the reading to increase as the knob is turned clockwise so the connection is to the lead diagonal from the adjustment knob. The third lead can be bent out of the way or cut off. It seems like it took a lot of words to say very little.

"Using this little pot, you can really set the meter right on the button. For someone wanting to do this, they can just hook up a good multimeter in series and apply a nominal current using, say, a receiver pack across a 10-ohm, 5- or 10-watt resistor (10 watt, RS 271-132). Anyway, you wind up with a pretty nice little meter for about $10." Another letter on a similar subject arrived from another old pen pal, Jordan Flakser, who wrote to tell about a problem he has encountered with a meter he purchased from Ace R/C. The meter is the one from Ace's Dual Metered Vari-Charger (DMVC) and, as used in this instrument, reads its output at 0 to 250 milliamps. However, when Jordan tried to use it in one of his own devices, but within the 250 mil range, it promptly pegged at full scale. Ace's fault? The meter manufacturer's fault? Neither; let's take a look at the situation.

My first assumption in that the meter must be of greater sensitivity and shunted so as to read the higher value correctly. However, neither Ace nor Bill Klein is using the simple parallel shunt I described last month, but a slightly modified version of the it. It is actually known as the voltmeter method of reading current and is preferred by some, as it can be done using stock resistor values without having to resort to making up small odd values of resistance.

Take a look at Bill's diagram. You will notice that the current would take a parallel path through the .1 ohm resistor and the meter/pot combination. However, as Bill points out, the ratio is 1:1500, and obviously almost all of the current will flow through the smaller value. Remember also that as the current through a resistance varies, the voltage across it also varies. And that is what we have here—the meter is actually reading the voltage across the .1 ohm resistor; the pot in this case is actually a multiplier that is adjusting the voltmeter range as necessary.

Taking a look at the circuit in the Ace R/C DMVC, we find almost the same thing, except that the component values are different. Well, in this case, let's take a look at my diagram of the metering circuit in the DMVC, as the one in the instructions is wrong! I couldn't believe it! Not Ace's stuff! Anyway, the meter itself is correctly wired, the other must be a not unusual drafting error.



If you have a DMVC and want to correct your schematic, simply add the one line and delete the other to match what I show here. In my charger, the calibration resistor is 56 ohms. This resistor is installed right at the positive side of the meter, and if yours is different, don't be alarmed. It is not another error, just that your meter has a different internal resistance.

The only consideration in this type of current metering circuit is to keep the shunt resistor as small as possible, and the ratio between it and the meter/multiplier as high as possible. The formula that Bill uses is the correct one and will work for you with the correct values for your meter and application plugged in.

## SOME TRICKS

Some tricks are possible when it comes to choosing that multiplier resistor, either for this circuit or for the basic voltmeter as I described last month. First of all, consider the limitations of your meter. If you are reading 1.5 amps on a two-inch dial, a few ohms one way or another are not going to make any more difference than your ability to interpret the meter's indications. However, the smaller the full-scale reading of the instrument, the greater the effect of an error in the multiplier resistor.

Bill's way of using a pot is one way, easily the simplest way. Another way it just to buy a dozen or so five-percent resistors of the values closest to the one required. They can be had for around a nickel a piece and vary enough one from the other so that usually one will be found that is right on the money or so close so as not to make any discernible difference.

Now, here is a real trick for you, if you are the type who demands the highest possible accuracy. You can actually raise the resistance of a carbon resistor by filing a notch in it! It is best to do so to at least a half-watt resistor. By using a small fine triangular or square file, as you cut through the outer covering and into the carbon, the resistance will increase. If done, it is best to rig up the circuit completely as it will be used, all soldered connections, no clips, with the multiplier in place being lower in value than actually required. After adjusting the current to a known value, file the resistor until the meter reading coincides. The cut in the resistor is then best protected with a drop of epoxy. If the resistor is not mounted on a circuit board and has been filed enough to weaken it, a length of shrink tubing over it will restore its mechanical strength.



See how much you get out of EC. I bet all this time you've been thinking that only variable resistors were variable resistors!

## AMA NEWS

As of June '88, there were some changes in the makeup of the AMA Frequency Committee, with some highly visible deletions, which you will notice if you have kept up with this august body in the past. Anyway, the current membership consists of: Fred Marks, Chairman; Jack Albrecht (Airtronics), Chuck Ahern, Larry Dungan, Walt

Good (Emeritus), Lance Halle, Steve Helms (Futaba), Dave Hilsenhoff, Bill Hershberger, Bob Novak (Novak Electronics), Charles Perrone, Warren Plohr, George Steiner, Ben Tolley (MAAC Canada), Bob Underwood (AMA Liaison), and Peter Waters (Kraft Midwest).

The company names in parentheses were added by yours truly and do not appear in AMA's handout. I included them in case you wish to locate and contact a member, though I am sure any and all of them can be addressed in care of AMA.

That's it for the year! Yes, the year! Can you believe it is December? Hope yours is working up to be merry, and go easy on the nitro during the New Year celebration. I'd like you to be here in '89 to read EC! •

**Choppers. . . . .** *Continued from page 21*

are drilled, sanded, and lacquered; and the canopy doesn't need to be painted.

The recent trend in helicopter kits has been to leave everything completely unassembled. Saving labor costs is a valid reason for this change, but isn't it funny that it hasn't resulted in lower prices to the consumer. However, Kalt hasn't followed the trend and still maintains a high degree of prefabrication in all their kits. So with all the pre-assembled components, well-designed molded plastic parts, and pretty good instructions, the Cyclone goes together quickly and easily, particularly for the first-time builder.

The heart of what's unique about the Cyclone and what pushes it to the top of my beginner's choice list are the plastic composite sideframes and servo tray assembly. The usual sheet metal sideframes are limited as to how many bends you can put into them. No such limitations exist for the Cyclone, and, consequently, every clever gimmick you could possibly imagine has found its way into this chopper. Nearly every place a nut and bolt are used, the hole is countersunk so the nut is nearly flush and is prevented from turning. An enclosed rear compartment for the gyro is molded into the frame, as are the tail boom support and the various bearing blocks. Most important, however, is that the two halves of the sideframes are molded in such a way as to gain tremendous rigidity and strength without much of a weight penalty. Of course, it's not only the sideframes that benefit, but everything enclosed within them. The few molded pieces that make up the servo trays are equally solid, giving good support and protection to the servos. That's not to say that they won't ever break in a crash; but, as we know, the nature of plastic is such that it will bend and snap back to its original shape unless, of course, it bends just a shade too much and simply snaps in two!

What drives me nuts (and everyone else I've talked to) is that hard landing that bends the sideframes just a little, throwing the engine, clutch, and mainshaft alignment out of kilter. You have no choice except to pull the whole thing apart, and I've never met the man who can straighten a bent sideframe and get it right; so you might as well just throw it out and buy another one.

The recommended powerplant for the Cyclone is a 50 engine, and I used an O.S. 50 FSR-H I had sitting around. The motor mounts are drilled and tapped for either the O.S. 50 or Enya 49, and carburetor arm extensions are included for both of these engines—another nice touch. There are people stuffing 60s in this machine, which might soup up the performance, but I feel it may be too hard on some of the components.

The collective pitch system is the typical Kalt sliding rod which travels in a slot in the rotor shaft and connects up to the Bell-Hiller mixer. I only needed to use a portion of the total available throw to get the pitch range of +8 to -2 that seems work best on this helicopter. I have read of people having a problem with the slide ring being a little sticky on the main shaft, but it hasn't happened to me. I think they changed to a harder plastic and solved that problem.

The tail drive system is a friction belt drive, which attaches to a pulley situated right below the main gear. At the other end, the belt runs in a steel pulley supported by two ball bearings. I see a few raised eyebrows from some of you oldtimers who flew the American Mantis with its friction belt tail drive. There are some advantages to this system and some disadvantages. On the plus side is the matter of "tail taps," a common occurrence for the beginner learning to hover. Helicopters with a tail drive shaft incur damage not only to the tail blades and blade holders, but all the way up to the plastic or nylon main gear, which is usually stripped by the pinion gear from the abrupt stop. This little miscue can very easily cost you $15 to $40 on those helicopters. Hitting the tail rotor on the ground with the Cy-

clone will probably do no worse than cause the friction belt to slip for an instant. The other side of that coin is if the belt is allowed to loosen or some oil from the engine gets on the front pulley, that belt may slip when it's not supposed to. A quick torque to the left is the result, and the consequences of that may range from "a little scary" to "crash." The friction belt arrangement is a factor that keeps the Cyclone inexpensive, and I think it's perfectly okay for the beginner. Personally, however, I'll put the toothed belt option on mine before I start doing any hotdogging.

Another thing missing is an autorotation clutch (though this is available as a fairly expensive option). Again, for the beginner, an autorotation clutch does nothing good. How many times have you seen someone put a helicopter down a little hard or a little crooked; and just when you think they got away with it, that rotor blade comes around and whacks the tail boom. In the learning phase, you'd like to be able to make that rotor head slow down and stop as fast as possible. That's the exact opposite of the freewheeling rotor you want for autorotations. Add to that the fact that those Torrington bearings are relatively fragile and quite expensive, and you can see why you're better off without one until you're into forward flight.

Like all Kalt helicopters, the Cyclone has belt starting for the engine, which I don't personally like; but I conceded that not having to go through the laborious clutch/start shaft alignment does speed up building time considerably. My biggest objection to the belts is simply that they break, but nothing is worse than a clutch shaft that wasn't installed right.

Time was when manufacturers took all the hardware, tossed it into a bag, and said: "have a good time." Nowadays, Kalt, like a lot of other companies, have the specific hardware needed for each stage of construction in an individual bag, numbered to match the corresponding section of the instructions. Everything being so well organized makes it practical to construct each subassembly separately, putting everything together at the very end. That doesn't take much room, which is perfect for me because most of my building is done on a coffee table in the rec room while watching TV with my wife and kids.

My first impression of the canopy was that it was ugly; but as I realized how well designed and functional it is, it suddenly became a lot prettier. It's like the basic two-piece design of all Kalt canopies, a yellow opaque ABS plastic section on the bottom and clear plastic on top representing the windshield. The difference is the third piece, a nylon frame that fits in a groove along the entire back edge of the canopy. This provides rigidity to the structure, as well as handy place for attaching the canopy to the helicopter. Four holes at each corner of the frame match tabs molded into the frame; and four screws hold the two together.

Also held on with four screws is the mounting plate for the receiver and gyro switches. The precut holes in the plastic plate fit the JR, Futaba, and JMW gyro range selector and switch, and at least the JR and Futaba receiver switches (because those are the only ones I tried.)

It's hard picking out things I didn't like on this chopper because I can't ignore the price consideration. Nevertheless, some things could be improved at minimal additional cost.

As ingenious as the canopy is, removing it still requires unscrewing four screws that are a little hard to get to. Quick-release canopies are the thing now, and I'd like this changed to give faster and easier access to the radio compartment.

The 3mm x 10mm brass-plated Phillips head screws are too large for the holes, and I had to switch to smaller screws in many places. I'd like to see them replace the friction belt with a toothed belt, even if it means that the price of the chopper has to go up. Also they need a less expensive autorotation clutch because that's an option that most Cyclone owners will exercise sooner or later.

I might just comment on some trends that have emerged in the past year or so in R/C choppers, partly because of the changes in the FAI rules. It has always been a matter of pride with helicopter owners to own a helicopter that was the ultimate in engineering—beautifully machined parts, highly polished; minuscule tolerance in fit; with ball bearings supporting virtually

every moving part. A helicopter like this could last forever, if you never did anything more than hover in your backyard. But there's a new breed of pilot out there now who are pushing their machines to the limit and beyond. They try new maneuvers, crash, rebuild, and try again. What they need is a helicopter that is light, can handle the stress of high speed aerobatics, and is tough enough to survive a crash. It must be easy and inexpensive to repair or rebuild. You have probably already realized that the attributes of this type of chopper also coincide with the needs of the beginner. So, when I tell you that the Cyclone is perfect as a beginner's first machine, that doesn't mean that I'm not going to stick a Blackhead 1 rotor head, autorotation clutch, and cogged belt tail drive on mine the minute this review is done.

**TEST FLIGHT**

I set the pitch at about eight degrees positive and two degrees negative, which gives a smooth climbout and a reasonably fast descent, without being touchy on the collective. I have a lot of stick time on a Baron 50, which has a lot of the same flight characteristics. A slower rotor speed, particularly at hover, gives a very smooth, almost lazy performance that will allow the beginner to stay well ahead of his helicopter. As with most Kalt helicopters, lock-to-lock throws and high rate on all controls is needed in the setup. The tail rotor is not as quick as I like, but, again, a quick tail rotor isn't what's needed by the new pilot. With the stock setup, this is a great helicopter for hovering and slow forward flight.

With the gyro installed in the rear port, about five ounces of lead in the nose plus a 1200 mA battery were needed to balance right on the rotor shaft. All-up flying weight: ten pounds.

Next month I'll be writing about the radio I used in this chopper: the JR Max Computer radio. •

**Technical** .... *Continued from page 39*

of the seven pages of data is a separate table, rating 35 different species of woods used in aircraft, with respect to each other on a particular mode of stress, such as "Fiber Stress in Bending-Specific Gravity Ratio," "Compression Strength-Specific Gravity Ratio," "Shear Strength-Sp. G. Ratio," etc. On most counts balsa is either the poorest of the 35 woods or one of the poorest. If you want a copy of this test report, send me a buck.

**COMPOSITES**

The plastic foams are a lot lower in density than balsa, and we can use them with versatile high-strength medium-density materials, such as fiberglass, carbon fiber, and Kevlar, to make semi-monocoque and sandwich structures, which are far stronger for their weight than balsa, do not absorb liquids, are sometimes easier to build, and cost less than balsa. Bye, bye balsa. It will take a few more years. Change is as slow as it is inevitable.

A few construction articles have been published on models which used corrugated pasteboard as the chief construction material. The object usually was to avoid the high cost of balsa. Old furniture boxes are free. Actually, corrugated board has a pretty fair strength-to-weight ratio, since it is a sandwich with a low-density core, but it is very absorbent, the corrugations of the core usually show on the surface, it doesn't form smooth curves, and it is

hard to finish the edges well. Most of the resulting models looked very crude.

**FOAMBOARDS**

Some models were also primarily built from cardboard-fenced foamboard (such as Fomecore, which has face skins about .012 inch thick). This was a step up, since the material is smooth and has a very good strength-to-weight ratio, but the paper faces are not waterproof. I designed and built an R/C Seaplane out of Fomecore several years back. It was cheap, light, fast to build, and looked good, but, in spite of what I thought was a good finish sealing job, the water got under the paint somehow and soaked up the paper facing on the foamboard. It then looked like heck, was weaker, and took forever to lose its added weight of water. If you are not building seaplanes and can keep fuel from soaking the paper plies, this is a good material.

In 1981 or 1982, Aerolite Products, Inc., of Buffalo, New York, marketed an Aerolite Foamboard, in several thicknesses, for model building. It had .004 inch ABS plastic skins on both sides of a core of expanded polystyrene foam. It seemed beautiful! Very light, smooth, pure white, inexpensive, easy to work, curvable, bendable, glueable, waterproof, fuelproof, and all those good things. Well, *almost* all the good things.

I designed and built several R/C models mainly using this plastic-faced foamboard. They were good models *except* that they kept having unexpected structural failures! I'm not sure exactly what the problem was, but it appeared to be cracks which would grow in length with use and eventually rip through entirely on a hard landing, or even in flight. The stuff seemed to have good strength *initially*, but it did not stand up. I had one pair of floats built from this foam board, which had a short life, and two fuselages, which both failed in the air! In one case, a seaplane fuselage separated completely in two, just forward of the wing. The engine, prop, muffler, battery, receiver, and the throttle servo went to the bottom of the lake! I got the impression that I didn't save any money by using an inexpensive material. After a time, Aerolite stopped marketing this foamboard. One wonders if they had other reports of failures similar to mine. This same material is now made in West Germany and is available under the name Artcore from some paper products distributors and art supply houses. If you have trouble finding it, call the distributor, Fomeboard Co., in Los Angeles, at (213) 588-9211. I will tell you why you might want this treacherous stuff in a moment.

There is also a stronger foam board available under the trade name Gator Foam. It is available with closed-cell foam in either 3/16 or 1/2-inch thick 4 x 8-foot sheets. (The half inch might be about right for a half-scale 747 model.) The skins on Gator Foam are .025 thick resin-impregnated paper, which makes it heavier, harder, and stronger than either the Artcore or the Fomecore. It may be a fine material, especially for you big bird boys and giant scale gents, but check out an apparent brittleness before you commit yourself to it.

**FIBERGLASS SANDWICHES**

In spite of structural failures with Artcore, the material still interests me. It has many fine properties (also, the lake is still hungry for R/C gear). It is available in 1/16, 1/8, 3/16, and 1/4 inch, and, except for the 1/16 inch, it is even lighter than soft balsa (the face skins are always .004). I continue to use it for bulkheads, etc., but if I ever use it as is in a tensile application again, I hope someone beats me over the head with a Quadra. Beware of the "as is" condition, but it is an excellent starting material or core for a fiberglass sandwich. The thin ABS skins peel off quite readily, leaving a smooth, accurate sheet of light but strong foam, which takes epoxy and glass nicely.

The full-scale homebuilt trade uses a thin sheet foam material known as Clark Foam for making fiberglass sandwiches. My tests on a sample of Clark Foam showed it to be 4.3 lb./cu. ft. (pretty heavy). Also, it is not sold in sheets thinner than quarter inch. Another sheet foam called Rohacell is advertised for modeling by Composite Structures Technology, 3701 Inglewood Ave., #268, Redondo Beach, California 90278-1110. It is available in both 1.9 lb. and 3.1 lb. densities, and in sheet thicknesses from .039 to 2 inches. Rohacell is imported from Germany, and its biggest drawback is a high price. So, stripped Artcore remains my fiberglass sandwich foam core material of choice.

Actually, I often leave the ABS skins on the Artcore when I use it as the makings of a glass sandwich. The thin plastic doesn't weigh much; it adds some strength, helps keep the sheet flat while the epoxy is curing, and it is much harder and smoother than the bare foam, making for a smoother finish on the final fiberglass. The bottom of the hull on my latest .60-size seaplane is 3/16 Artcore with the ABS still on, plus a layer of .6 oz. glass inside and a layer of 1.5 oz. glass on the outside.

One more recipe before I leave Artcore/Fiberglass sandwiches. Put a parting agent, such as PVA, on a sheet of glass (yes, window glass this time), or on a polished, flat sheet of metal. Squeegee a film of epoxy on top of the PVA. Lay a sheet of fiberglass cloth on the wet epoxy, pull out the wrinkles, and squeegee it down until the cloth is uniformly wetted. Squeegee a film of epoxy onto a sheet of Artcore, or a part cut from it. Press the epoxy-wetted Artcore face onto the epoxy-wetted fiberglass on the glass, starting from one edge. Look through the glass side to check for complete bonding all over. Let it cure thoroughly. Peel the sandwich off the glass (try passing a thin piano wire between glass and sandwich). (Serves six.) If you add a little pigment to the epoxy, you will not only have a "gel coat" with a high-gloss, glass-smooth surface, but also a colored epoxy finish, with no sanding, no painting, and no polishing! (I hate sanding and painting.) Pigments compatible with epoxy are available in 17 different colors and in 4-ounce jars and up from BJB Enterprises, Inc., 13912 Nautilus Drive, Garden Grove, California 92643; phone, (714) 554-4640.

**SCULPTURED FOAM**

We have been talking about foam/fiberglass sandwiches which are flat or nearly flat, but not all areas of our models are flat. Pre-built fiberglass sandwiches could be wrapped around ribs for wing skins, could be used for tail feathers, for slab fuselage sides, and for boxy floats, but we need a foam-and-fiberglass approach for tight curves and compound curves. Since we can cut most foams easily with a hot wire, saw them, carve them, and sand them, we can make model parts of any shape from plastic foam quite readily and inexpensively. Such parts, by themselves, will seldom be strong enough, however. We can make them strong enough by covering them with fiberglass bonded with epoxy.

Most of the commercial molded-fiberglass model fuselages are made with polyester resin, not epoxy, and many of you have used polyester at one time or another. For use on foam it is a no-no. Most of the foams are rapidly dissolved by the styrene monomer in a polyester resin mix. (Urethane foams are unaffected, but they are more dangerous to work with.) Furthermore, polyester stinks up the house and is

more difficult to get out of brushes, etc.

**EPOXIES**

So let's stick with epoxy. Epoxy costs a little more, but the small amount you are going to be using will be paid for from the balsa wood you didn't buy. One word of warning, however. Some people develop an allergy to epoxy resin. Keep it off your hands as much as possible and wash it off yourself with soap and water or alcohol immediately, if you do get into it. If you exhibit any reaction to it, wear rubber gloves.

No special epoxy is needed for fiberglass work. The epoxy "glue" you have been buying at the model shop is fine for laminating, provided its cure time is long enough. For a very small simple fiberglass patch, 5-minute epoxy is okay, but fiberglassing takes some time, and even 30-minute epoxy is going to set up before you are ready, on any but fairly small jobs. I have found little in life more frustrating and discouraging than to have the epoxy mix start to gel when the job is only three-quarters done. It sets in the brush and on other tools, things stick to you, the glass fabric becomes a bunched-up mess, and . . . .

I'm sorry, but Bill says, "When you get to 2500 words, stop." In the meantime, "If you think you can (design models), you are right. If you think you can't, you are also right." Henry Ford. •

**R/C Guff. . . . .** *Continued from page 15*

sheet metal fastened to the fin (at P). The hole may be punched with the pivot pin for correct size. Make sure the flap turns easily, but allow no looseness. Glue the piano wire rudder arm strongly to the flap.

The stabilizer has three spars: front, rear, and trailing edge spar. The latter is just ahead of the elevator tab. All spars are 1/8-inch hard sheet. Be sure they are straight. Section A-A shows the streamline rib profile. The ten center ribs are cut to this shape. Note the two center ribs are of 1/8 inch sheet and are angled to the taper of the fuselage. Each tip rib is made by the "cut and try" process after the tip is in place. Since the spars cut all the way through the ribs, it is necessary to slice each rib into three pieces.

Start assembly by gluing center portions of ribs between the two spars, making sure there is no warp. When dry, attach remaining rib portions. Cement on 1/4-inch square hard balsa leading edge and 1/8-inch sheet tip. Wire hooks, with the aid of rubber bands, hold the tail assembly on the fuselage. So, use plenty of glue when placing the hooks. Cover the indicated portions, top and bottom, with 1/32-inch sheet balsa.

The trailing edge of the elevator flap is easily cut from a sheet 1/8 x 2 inches. In fact, all 1/8-inch sheet tip pieces can be cut from 2-inch width material. This flap has pivot pins at the front edge the same as the rudder. Sheet metal bearings at P.

Cover all tail surfaces with bamboo paper and water spray. Two coats of clear dope is sufficient. Cut holes in tail wing for fin spars. Glue fin in place and give the whole thing one coat of colored dope. Don't worry about warp, if you've built the framework true, parts are just too stiff!

**WING**

The eight-foot wing is in two sections for convenience of transportation; that is, to fit the family car. Four small nuts and bolts (6-32) hold the assembled wing together. This system has proved satisfactory, even through much hard usage.

Select hard, firm balsa for the spars, front and back. If four-foot lengths cannot be obtained, splice shorter ones together with a long diagonal joint. The root of each spar is reinforced on each side with a sheet of 1/16-inch plywood. To this firm base bolt (6-32) and glue the dural wing fasteners. Each rib is cut into three parts to allow for passage of the deep spars. First assemble the center rib portions and the two spars. This insures having the spars parallel. Remember the 1/4-inch root rib goes on with a slant to give the proper dihedral. Next add the nose ribs and leading edge. The 1/4-inch false nose ribs strengthen the place where the wing rubbers go. Now glue the trailing ribs to the rear spar and before the glue is dry add the notched trailing edge. (*Editor's Note: Our plans show a one-piece rib for more conventional construction, along with suggested spars and webbing.*)

The wing tip of hard 1/8-inch sheet is assembled on a flat surface and then glued to the wing. By the "cut and try" method, hack the two tip ribs to the proper size. Holding a straight edge (parallel to spar) on top of tip ribs will help indicate the correct taper.

Add the various braces shown and give all joints an extra coat of glue. This wing will take a beating. The medium 1/32-inch sheet balsa covering is placed on top and bottom of portions indicated. Cover with bamboo paper and finish as with tail assembly. The external holes in the dural fasteners are drilled while holding the two panels in position to insure perfect alignment.

The ship is found easy to fly and should be flown before the radio is installed. If the ship itself is well tested, the radio installation will be much easier.

Balance the ship at the 40-percent mark on the wing (about 5 inches back from leading edge). Set everything neutral except for about one degree right thrust on the motor. A good test is 2/3 power and 30-second motor run. A few glides from the hand will detect any extreme misadjustment.

Run beside the wing tips on a few power runs, letting the ship take off but not allowing it to go free. When satisfied with the adjustment (but not until!) let her go.

The climb will be slow and the glide flat. Try for straight-line power flight and glide with neutral rudder.

Now for the fun of putting in the radio control! •

**R/C Soar. . . . .** *Continued from page 43*

hint), I could turn you on to one of their club officers. However, I do know from Rich Border's MVSF newsletter out of New Jersey that the CASA club has special contests at such venues as the National Geographic Society's HQ in Gaithersburg, Maryland, and cross-country races around Dickerson, Maryland. You could contact the Contest Director of one such event, a CASA member named Al White, P.O. Box 303, Rouzer-

ville, PA 17250. Al can find you some fellow sailplane fliers to get your flying shots.

**AIRFOIL OF THE MONTH: E214**

It may seem to devoted readers like this section of the column has been overlooked the past few months. Well, if the truth be known, there have been 11 airfoils run in 11 columns for the year 1988. Not all of them have been called by their official title (as above), not all of them have had coordinates published (not available), and not every column has had an airfoil of the month (I did skip a few), but there have been 11.

This month we have a bit of a repeater. The Eppler 214 airfoil section was first run in "R/C Soaring" way back in September 1983! I guess you could say it's been long enough to have another go at it!

This time we are going to show what we have learned since 1983. New information has come to my attention in regard to wind tunnel experimental data gathered at the University of Stuttgart, FRG, by Dieter Althaus. The data is not new. It has been in existence since the summer of 1985. However, I first saw it when Michael Selig sent it my way about a year and a half ago.

The format of the data was quite different, and almost unrecognizable at first. It is shown basically the same way as the Eppler-type data graph, but the drag axis is highly compressed. In similarly sized polar graphs, what took the space of 50mm along the CD axis in the Eppler book was squeezed down to 7mm in the Stuttgart graph, eliminating much fine detail in the progress (my opinion). That's why the curves don't look familiar.

I took the time to sketch in the theoretical Eppler data points on the E214 at 100,000 Rn over the Stuttgart graph. I make no claim for high degrees of accuracy on my lines, but they do give close approximations.

Needless to say, and perhaps to no one's surprise, the computer program's data didn't agree with real experimental data. The wind tunnel was not so favorable to the E214 as the computer. It shows about 30 to 40 percent more drag between CL .3 and 1.0 at 100,000 Rn; it shows the lift generated per angle of attack about 5 to 10 percent less optimistic, and it shows (surprise) that the pitching moment is less severe than predicted by about 25 percent.

At 60,000 Rn, however, the wind tunnel picked up a *huge* drag increase between CL .2 and 1.1. This is probably due to a premature flow separation along the top surface (a big bubble?). As many longtime readers may recall from previous columns, the Eppler program can only predict flow separation problems, not assign specific values of drag to go with them. That is why the 50,000 Rn curve in the MTB Eppler book looks much like the 100,000 Rn curve, and not like this one from Stuttgart.

In conclusion, the E214 in the tunnel doesn't look as good as it does on the computer program. However, that's probably going to prove true with all Eppler program designed sections in the MTB books. We shall see. Where we will start to gain useful knowledge is when we can compare many different sections in the same tunnel against each other. Meanwhile, the E214 looks like a bad choice for a small, slow R/C glider because of the drag problems at 60,000 Rn.

**GOOD BYE FOR NOW**

Stay tuned next month for more exciting news and views from the model soaring world. With any luck (and a stretched deadline), we may have a report on what's new in the industry as seen at the RCHTA Chicago Model Show. Thermals, Bill Forrey, 3610 Amberwood Ct., Lake Elsinore, California 92330; (714)245-1702. •

**Counter. . . . . *Continued from page 11***

Last, but not least, is a new Snuf-Ler muffler from J'Tec. This is the answer to AMA's muffler rule suggestions and is designed to keep noise to a minimum. It is constructed of thin-walled steel and a chemically applied heat and corrosion-limiting black finish. Three chambers separated by perforated baffles combined with the single chamber stock muffler will lower decibels with no power loss, and in some cases, actually increase rpm! The muffler will attach to the front half of any stock muffler, from .25 to 1.08 O.S. Max, Super Tigre, Enya, Fox, K & B, Royal, Asp, or Irvine stock mufflers. The Snuf-Ler will substantially reduce exhaust sound with improved idle, better fuel economy, and no power loss. Look for it at your favorite hobby shop. •

**Plug Sparks. . . . *Continued from page 33***

**Class B Ignition** (24)

| | | |
|---|---|---|
| 1. Walt Geary | (Zipper/OR 29) | 1088 |
| 2. Joe Percy | (Bomber/OR 23) | 1074 |
| 3. Cy Jordan | (Playboy/Forster) | 1029 |
| 4. Dick Huang | (Kerswap/Torp 29) | 1004 |
| 5. Larry Jenno | (Kerswap/Torp 29) | 896 |

**Pure Antique** (22)

| | | |
|---|---|---|
| 1. Eut Tileston | (Westerner/Spitfire) | 1606 |
| 2. Walt Geary | (Bomber/Spitfire) | 1537 |
| 3. Cy Jordan | (RC-1/Orwick) | 1518 |
| 4. Bob Walter | (RC-1/OR 60) | 1365 |
| 5. Chet Lanzo | (Bomber/Cyke) | 1343 |

**Summary of Winners**

| | |
|---|---|
| F/F High Time Champion | John Bortnak |
| R/C High Time Champion | Eut Tileston |

**Perpetual Trophies**

| | |
|---|---|
| Compressed Air | Jim Noonan |
| Ernie Shailor | Ben Cleveland |
| Richard White | Sal Taibi |
| Danny Sheelds | Ed Wallenhorst |
| Ed Kelly | Jim Walston |
| Marquadt | Mitch Post |
| Feather Merchant | Joe Percy |

**ENGINE OF THE MONTH**

Once again, this writer is indebted to his old San Diego buddy, Bill Thompson, who dug deep into his rare engine file to come up with this month's engine.

The Trident 65 is one of those engines made right after the war aimed at the speed market. This engine, designed and built by "Zip" Gandell, shows influence of Atwood engines. This is no great surprise, as Gandell was employed by Miniature Engines in Southern California.

According to reports printed in the Model Engine Collectors Journal, the Trident was built in ignition and glow plug versions. Best sources indicate only a small number were built.

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2 Ch Rcvr
ARI032130 $22.95

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ARI0152 $68.75

ARI0150 $62.50

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WANTED: Ignition model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, Oklahoma 74063; (918)245-3649.

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1930s MODEL SHOP! Sawed prop blanks, WWI/Balloon/Streamline balsa wheels, Hinoki wood, color nitrate, sticks, tissue, bobbins, prop hinges, bamboo, old Scale/Contest plans, and more! Illustrated mail order catalog: $2. Oldtimer Model Supply, P.O. Box 7334, Van Nuys, California 91409.

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Gandell, who was a flying buddy of Irwin Ohlsson, will be remembered for his "Little Zip" design. This model closely resembled a Miniature Ohlsson Pacemaker. "Zip" is gone now but he is fondly remembered by Irwin.

The Trident was a well-made engine featuring a nicely finished black crackle finish. We didn't dare take the engine apart so can only assume dimensions are very similar to the Atwood Super Cyclone .649.

**50 YEARS AGO, I WAS . . .**

While at the 1988 Indiana SAM Champs held at Lawrenceville, Illinois, this writer received Photo No. 13 from Barney Onofri, 78 Harrison Avenue, Morrisville, Pennsylvania 19067.

Barney tells us the model is a Trenton Terror modified into a six-foot parasol powered by a Brown Jr. engine. This photo was taken at Mercer Field near Trenton, New Jersey. Tremendous amount of gas-powered model flying in the Trenton area between 1935-40.

The next photo, No. 14, although only dated 1973, is a good shot of a Gladiator as designed by Maurice Schoenbrien. Built by Bud Perry, this 1941 design powered by a Super Cyclone is silkspan-covered doped with nitrate and "RIT" dye (scarlet and Royal Yellow). All this was followed by one coat of enamel or acrylic paint known as "Emron." Bud fully acknowledges the paint work being done by his buddy H. O. Hunnicutt and the photo taken by George Wilson III. We don't know if Ace Hobbies is still in business.

**ROBERTS TROPHY CLARIFICATION**

After reading the description of the Good Brothers and their subsequent winning of the Roberts Trophy, a statement was made that this was the original Roberts R/C Trophy which is correct yet incorrect as an earlier Roberts Trophy was awarded to Chester Lanzo in 1937 for the R/C Event.

This confusion was brought about by the Elmira, New York, meet sponsored by the Soaring Society of America, Richard

DuPont, president. The purpose of this rather prestigious meet was to acquaint the young people in the gas model events with gliding and soaring activities.

As reported by Phil Zecchitella in his "Gas Job Gossip" column, *Flying Aces* September 1937, this meet was to be held on June 5 through 9 during the Soaring Society's Annual Elmira Gliding Contest.

These dates were selected several months in advance with news of the contest widely circulated and published. Some time later, NAA decided to hold its Nationals in the final week of June and first few days of July at Detroit.

With everything running like clockwork with two major contests available to the modeling fraternity, something had to go wrong.

When the Detroit hotels were approached for reservations for the modelers, it was found the selected dates conflicted with a large convention already scheduled. Instead of moving the events to a more suitable time, NAA decreed the Nationals would be held July 7 through 11, completely ruining the contest dates for Elmira. When asked why the cancellation of the Elmira meet, it was revealed the flying schedule occupied the selected airport over that particular period.

This was a severe jolt to the Soaring Society, as many months of planning and preparation had gone into this proposed Elmira meet. Rather than take a hard-nosed attitude with the Junior NAA, the Society donated all their trophies and awards to the NAA Nats Committee for awarding.

Hence, when Chester Lanzo won the Ed Roberts Trophy for R/C Flying, it actually was the Elmira Contest Trophy. As far as can be determined, there was no provision for this trophy to be a perpetual type. So, again, Roberts donated another R/C Trophy to the 1938 Nationals, this time to be a perpetual award.

In the intervening years, Chester Lanzo donated his Roberts Trophy to the Society of Antique Modelers to represent the highest time attained in the Texaco R/C Event at the SAM Champs.

This trophy was fitted with a suitable base built by Walt Parker and suitable nameplate by John Pond with all past winners engraved. After Don Bekins won the trophy at the La Junta SAM Champs in 1983, Don had the trophy completely silver-plated, making the trophy well worth the competition!

In some respects, SAM can lay claim to having the original Roberts Trophy regardless, whether it was intended as a standard award or a perpetual trophy. There is no question what it is now!

**MORE SAM CHAMPS**

Thought you were going to get off easy, huh? When Harold Johnson takes photos, he takes so many good ones, it is hard to resist including them in the column.

Such is nice action photo, No. 15, of Hans Oschner letting go his Madewell DeAngelis design in the 1936-37 period. These very squarish designs (the Trenton Terror is one of Mickey's) are easy to build and do trim out quickly. Just the type for someone who needs a good flying model in a hurry!

Photo No. 16 is of a model you don't see everyday: a Canadian Chilvers Record Breaker design of 1940. Richard Brace thought well enough of this model to reproduce it for the SAM Champs. Dick had a little tough luck in trimming the model out. Gettum next year!

**SAM ITALIA**

Latest letter from Cesare de Robertis located at Via L. Magalotti, 6, Rome, 00197, Italy, including Photo No. 17 of Arve Mozzarini's compressed air model known as the ARV-8.

This 1935 design features a fuselage of super thin brass which is the actual air tank. No reports on how the model performs.

Cesare also reports SAM Italia is very successful with 120 members in this short time. As usual, flying fields for free flight are always a problem, so the main events are R/C. A considerable amount of Ben Buckle

models (a British manufacturing firm) have been making their appearance.

As we receive photos from Italy, this columnist will feature original designs from Italy. Quite a few three-view drawings have appeared in the Australian SAM 1788 newsletter, *Duration Times*. If there is enough demand, we will start including these with the column write-up.

**VINTAGE STUNT CHAMPIONSHIPS**

Well, it was a long time coming, as this columnist had been pushing old timer control line ever since the Riverside Nationals. First sponsored by the writer and then taken over by PAMPA at the Reno AMA Nationals. The O/T control line events have fluctuated in attendance primarily due to lack of publicity. 1989 will be a different story.

Received a most interesting announcement from Mike Keville, 6618 Dashwood Street, Lakewood, California 90713, of the upcoming "Vintage Stunt Championships" to be held February 18 and 19, 1989, at Whittier Narrows, So. El Monte, which is south of Los Angeles.

Sponsored by the California "Knights of the Round Circle," AMA Chartered Club # 2389, this meet will feature two days of Old Timer (pre-1953) and Classic C/L Stunt Events.

If you have ever wanted to see the old boys in action, the contestant entry list looks like a who's who in control line: George Aldrich, Bob Palmer, Duke Fox, Ted Fancher, Bob Dixon, Joe Wagner, et al. This will be a high class *fun* meet!

As stated before, there will be two classes: Old Timer for designs kitted, published, or designed prior to December 31, 1952, and Classic for designs between 1953 to 1963. This should include old Veco kits plus many of the Detroiter-type designs.

In that line, Mike Keville has sent in Photo No. 18 showing "Olie" Olson's Super Duper Zilch with K&B 40 power being launched by Tony Gallagor. This Jim Saftig design is typical of the pre-1953 class designs.

Mike further states even if you don't enter, there will be a *fun* circle for those who are not competition-oriented. So mark this one down on your calendar: February 18 and 19, 1989!

**FREE PLUG DEPARTMENT**

The latest call from "A-J" Free Flight Specialties reveals that Russ James, proprietor, is still busy with "new" ideas for old timers.

His latest are aluminum mounts quite similar to the old formed steel mounts that were popular in the early forties. These come in two sizes (like the Army): big and small. Costs are $3.75 and $4.00 per pair, respectively. Gettum while they are hot from Russ James at 4840 East Leisure, Fresno, California 93727.

**THE WRAP-UP**

For a change, no obit this time, but some helpful criticisms of the 1988 SAM Champs as chaired by Don Sachtjen. Don sez the following lessons were learned:

1. Buck Zehr's scoreboard and scorecards were "too busy." They could lead to error. (The writer thought Buck's idea was great as did Don Bekins, future R/C Director.)

2. Let the sponsoring SAM Chapter sell shirts, hats, and badges to help out with expenses. Don reports 125 tee-shirts, 75 hats, and 21 golf shirts were sold. Avoid any small size shirts; no demand!

3. An alphabetical list of names versus contestant number is excellent as a timesaver.

4. Computers. Too much work for the desired results. Don reports he spent over 60 hours on the computer.

5. Put the free flight recording tables on a "low-boy" trailer for easy and quick relocation. This idea is invaluable on a variable windy day.

6. Finally (and one of this writer's pet gripes after getting a cc rating for the large regional West Coast SAM Champs), AMA Grants only two free memberships for a "cc" contest. Over a four-day period, this is simply too much to ask of any one Contest Director.

Don suggests for 1898 that the Champs be split up into four one-day SAM R/C Contests and four SAM F/F one-day contests. This would certainly alleviate the feeling that the normal AAAA Champs have been reduced to a club contest concept. Let's give the people who put in a lot of hard work a break! •

---

**Jake. . . . . *Continued from page 9***

*hump, but with a clearly different set of markings that look more like U-44.*

*Truly a remarkable find! You can imagine how excited we are. Look for us on the news any day now. Thanks again for your original help in setting up our radio control systems.*

*Scientist in Inverness*

Dear Scientist:

Amazing! Who would've thought that supposedly extinct Plesiosaurs would be found alive and well in a Scottish lake, and that they would look uncannily like sunken German U-boats? Why, even the nostrils that are visible in the first photo could be mistaken for torpedo tubes if you didn't know better. One small question, and I feel silly to even ask it, how do you account for the ladder that runs up the side of the hump?

Jake

* * *

*Dear Jake:*

*I bought one of those Flymo flying lawn mowers. They don't really fly, I guess. But they got no wheels and they ride around on a cushion of air like a hovercraft. Sounded good to me. Sure would beat pushing around an 80-pound monstrosity on tiny wheels that get stuck in every little ditch or crevice.*

*The darned thing doesn't work! If the ground's not perfectly flat, it doesn't fly at all. And when it don't fly, the danged blade chews the grass off about a half inch below dirt level. It won't cross any ditches or holes, or any other break in the ground's surface. And even when it flies okay, it doesn't cut any grass. Darn propeller blade under the thing blows all the grass down flat where you couldn't cut it with a Bic and a can of Foamy.*

*What do you suppose the problem might be?*

*Abraham Jennings McBride in Athens, Georgia*

Dear Abe:

The problem just might be that there are enough numb-skulled consumers out there who'll buy anything, that it makes it profitable for these flymo-by-night companies to put a product on the market that couldn't possibly work if anybody ever stopped to think about it.

Jake

* * *

*Dear Jake:*

*I am a high school student and I have signed up for a mechanical drawing class. My instructor has informed me that I will need a set of French curves in order to participate in the course. What exactly is a French curve?*

*Brad, Class of '89*

Dear Readers:

All right, I hear all of you out there. You're all saying here it comes, he's going to say something crude about female anatomy in Paris. Well, I'll have you know that this is a high-class column, and such boorishness is

not likely to ever appear in these pages. Read on, and learn to appreciate the level of erudition and sophistication exemplified by my work.

Dear Brad:

A French curve is where Citroens tip over.

Jake

* * *

*Dear Jake:*

*Consider the following poem which I composed while stuck in an elevator full of overweight shoe salesmen who had just eaten a Mexican lunch about an hour earlier:*

*Columbus sailed the ocean blue*
*In fourteen hundred and ninety-two.*
*Neil Armstrong set foot on the moon,*
*1969,*
*In the month after June.*
*Jake made his thousandth mistake,*
*In nineteen hundred and eighty-eight.*
*Inspired, wouldn't you say?*

*Laureate in Lawrenceville*

Dear Laureate:

Eight doesn't rhyme with mistake, and 1969 doesn't rhyme with anything. And your composition doesn't follow the rules of Icelandic Potentiometer.

Jake

* * *

*Dear Jake:*

*I noticed that* Model Builder *recently published plans for a model airplane with the unlikely name of "Foot Rot." I spent many sleepless nights trying to figure out where the designer came up with a name like that. Then I closely examined the cartoon that heads up your Dear Jake column. Now I think I know.*

*Lemming in Dallas, Texas*

Dear Lemming:

You obviously haven't read any of my letters on how to name model airplanes. If you had, you would know that the naming method I recommend is to wait until the airplane is finished and then look at it. Most aircraft will visually inspire some sort of word association that leads to a name. In other words, you name it after what it looks like.

This method has produced many memorable airplanes, including "the Green Manure Bucket," "Blanche's Varicose Veins," and "For Sale." A name like "Foot Rot" should come as no surprise to anyone. As a matter of fact, I very nearly named one of my 1974 designs "Foot Rot," but upon further reflection, I called it "Even Desenex Couldn't Help."

Jake

* * *

*Dear Jake:*

*My name is Dilland McNamara, III. My friends and associates call me Biff. My opponents call me from the poor house. I am a corporate attorney representing Yugo of America, Incorporated. A few months ago you slandered our product in print. That is going to turn out to have been a very costly mistake. Your derogatory claims of inadequate engine power and poor maintenance records were libelous and totally unsubstantiated. We have filed not only for defamation of corporate character and fraudulent testimony, but also for malicious intent to erode our earning power. We suspect that you shorted Yugo's stock on the New York and international markets, then published your product assassination in hopes of driving the share price down and thereby reaping a large personal profit. The SEC is aiding in the investigation of this charge.*

*Prepare a defense, if you have one. Our summons will be in your hands by month's end.*

*Dilland McNamara, III, LL.D.*
*McNamara, McNamara, and Koharski*
*Attorneys-at-Law*

Dear Biff:

I rest my case.

Jake



**Workbench. . . .** *Continued from page 9*

competition or in sport, seems to amount to nothing more than a handful of peanuts (sorry about that, Jimmy). However, the letters keep coming in, free flight bombed out at the '88 Nats, and flying sites aren't exactly on the increase. As in our previous discussions, we readily admit that frequency control is the major technical drawback at a meet of any decent size. The other major problem we have mentioned is getting a technically acceptable radio system in rubber-powered and towline glider competition models. It would seem that Half-A Texaco R/C proves that there shouldn't be any problem with any size gas model, though the smaller ones may have to concede to full fuselage designs instead of

stick-and-pylon.

Notice our reference to "technical" this and that. This means to say that we're not talking about the moral issues of the question, only the technical matters (Good grief, I'm beginning to sound like a politician!).

Ken McCall, of Pittsford, New York, sent in portions of an article from a 1965 issue of *American Modeler*, written by well-known free flighter Hewitt Phillips, in which he describes a method of installing an extremely lightweight R/C rudder system (1.3 ounces) in a conventional competition-type rubber model of 46-inch span and weighing just over 6 ounces, complete with 12 strands of 1/4-inch rubber and radio equipment. The lightweight actuator doesn't have the strength to deflect and hold the normal size rudder required to turn the aircraft; however, it doesn't have to! Thanks to an idea patented way back in 1922, the rudder is moved in the same way that the heavily loaded control surfaces of a DC-6, Boeing 707, and DC-8 are moved. It's a servo-tab.

In use, the servo-tab, sort of like a small, narrow trim tab on a control surface, is deflected in the *opposite* direction to that which is desired. As the tab moves, air forces developed on the tab push the main control surface in the opposite, or desired direction! Because the tab is small, it takes very little effort to move. If you want right rudder, you move the tab to the left and it forces the rudder to the right. Voila!

* * *

Texas has two Gilberts. One was the hurricane that hit the southern Gulf Coast in early September and the other is Dave Gilbert, of Houston, who issues the following warning to all free flighters:

*Beware ye champions of the pure flight form, for sinister forces are at work. As one of your fallen brethren, I am trying to do this one last decent thing in hopes that some of you might be saved from that soul-consuming monster called radio control.*

*It starts so naturally. Of course, you should experiment. Where would mankind be without this driving curiosity? After all, you are an intelligent individual and can decide for yourself when enough is enough. In so doing, you will have the facts firsthand to argue with those who would lure you away from your great love.*

*So, go ahead, install a radio in one of your old models and give it a try. Two channels is all you need, and you will probably only use one of those. Besides, you will want to practice that retrieval flyback from far downwind so you will be ready. The best way is to just keep it in close (directly overhead) until you get the hang of it. If you encounter lift, so much the better; might as well steer it over under that hawk or your buddy's model that is still going up. It is good practice; what the heck!*

*You have a real feeling for this; obviously some latent talent here just waiting to be used. Some of those guys couldn't drive a kiddie car in an empty parking lot. So, sit back in your chaise lounge and practice. Twenty-minute flights are routine and you can land it just a few feet away, or if someone is watching, drive it right toward you then stand up at the last second and make a one-hand catch. What the heck!*

*With this kind of flying you don't have to go far to find a field that is big enough. That means you can do it more often and you can get more flying time in each trip because you don't have to chase it. So you are getting pretty good at this R/C stuff. Certainly you could outfly old fumble fingers over there. Why not have a little fun and challenge those other guys to a little no-max contest? It would be good practice for everyone. Now for this, of course, you might as well use your good model; might even build a new one just for R/C. You could really show those guys some things. What the Heck!*

*Just to make sure though, maybe you should have a little better radio. You haven't used that motorcycle in months. You could sell it and get a really good radio, or maybe even two! What the heck!*

*Now having done all this, it just does not seem right to have to travel so far to have a "free flight" contest with the radios turned off. Why not stay home and have a contest with the radios on? Let the new designs take full advantage of the new control capability. Who knows, it might start another Golden Age or at least a Silver one.*

*At this point you are hooked. The R/C monster has you and you will never be pure again!*

*Welcome aboard; what the heck!* •

# Flight School.




## It's elementary with the Professor.

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Extremely stable design and ARF assembly are just a few of the features that make the Professor ideal for novice flyers.


*The complete Professor kit comes out of the box ready to assemble.*

Clean, quiet flying excitement is as close as the schoolyard. Let Futaba and the Professor show you how simple it can be.

Advanced, lightweight materials are used for the fuselage for exceptional strength and rigidity. And built-up, pre-covered wing, tail and stabilizer eliminate the need for special assembly skills. Simply join the wing halves, attach stabilizer, tail and pre-installed linkages. Mount the propeller to the gearbox of the powerful Mabuchi RS540SH motor, install radio and batteries and you're ready for takeoff.

| PROFESSOR SPECIFICATIONS | |
|---|---|
| Length | 35.04" (890mm) |
| Wingspan | 48.82" (1240mm) |
| Area | 446.5 sq. in |
| Weight (w/rec system) | 39 oz. |
| Motor | RS540SH w/3:1 reduction gearbox |
| Recommended system | Futaba 4NBL/MCR |

**REQUIRES:** 7.2v/1200mAH NiCd battery pack and charger, 2-4 Channel radio control system (electronic speed control optional).

***Futaba MCR-4A Integrated MOSFET speed control receiver (Not included) required for optimum performance. Specifications: 4 Channel; 1.5 oz. (excluding switch and connectors); 1.24" x 2.92" x 0.63" BEC Voltage regulator.***

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