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
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REVIEWS:
SIG NINJA
KYOSHO
CONCEPT
30 SX
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MERCO**
.61 ENGINE



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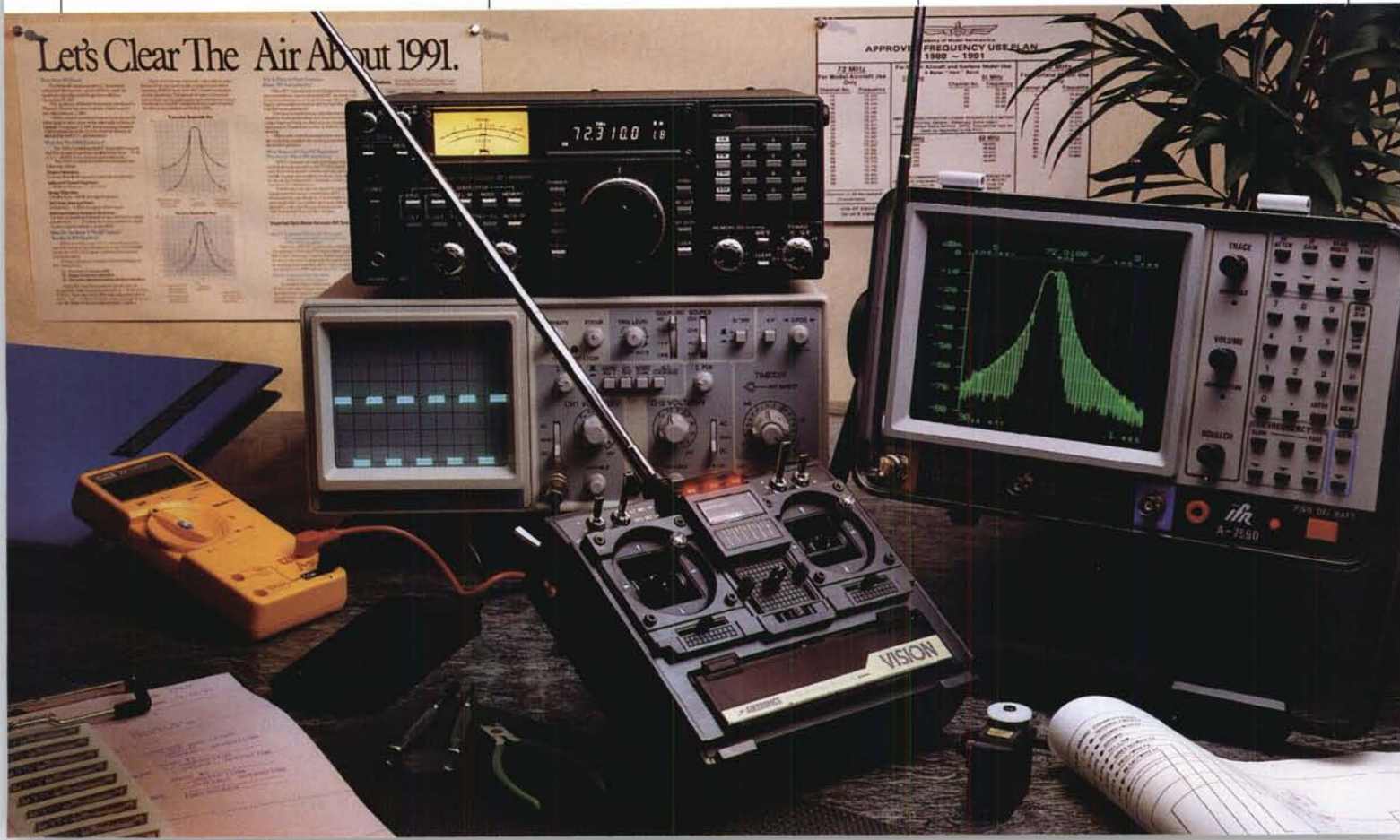
We're helping advance the sport of R/C modeling through excellence in our equipment. Airtronics continues to develop new products and technology to keep us ahead of the competition.

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ON THE COVER

Culpepper Models "Chuperosa" cruises over the Atlantic Ocean at Cahoon Hollow Beach, Massachusetts, an excellent location featured in "Soaring at Cape Cod" on page 54, photo by David Garwood. Insets: Sharon Lee holds F-15 Eagle from Combat Models featured in "All About ARES", page 68, photo by Art Steinberg; three Byron P-51's built and flown by Stan Sibley are described in "Strictly Scale" on page 72, photo by Al Tuttle; and The Sig "Ninja" kit is reviewed on page 88, copyrighted photo by Ed Kreiser Photography. Also, a subscriber has won a Airtronics radio control system, see page 91.



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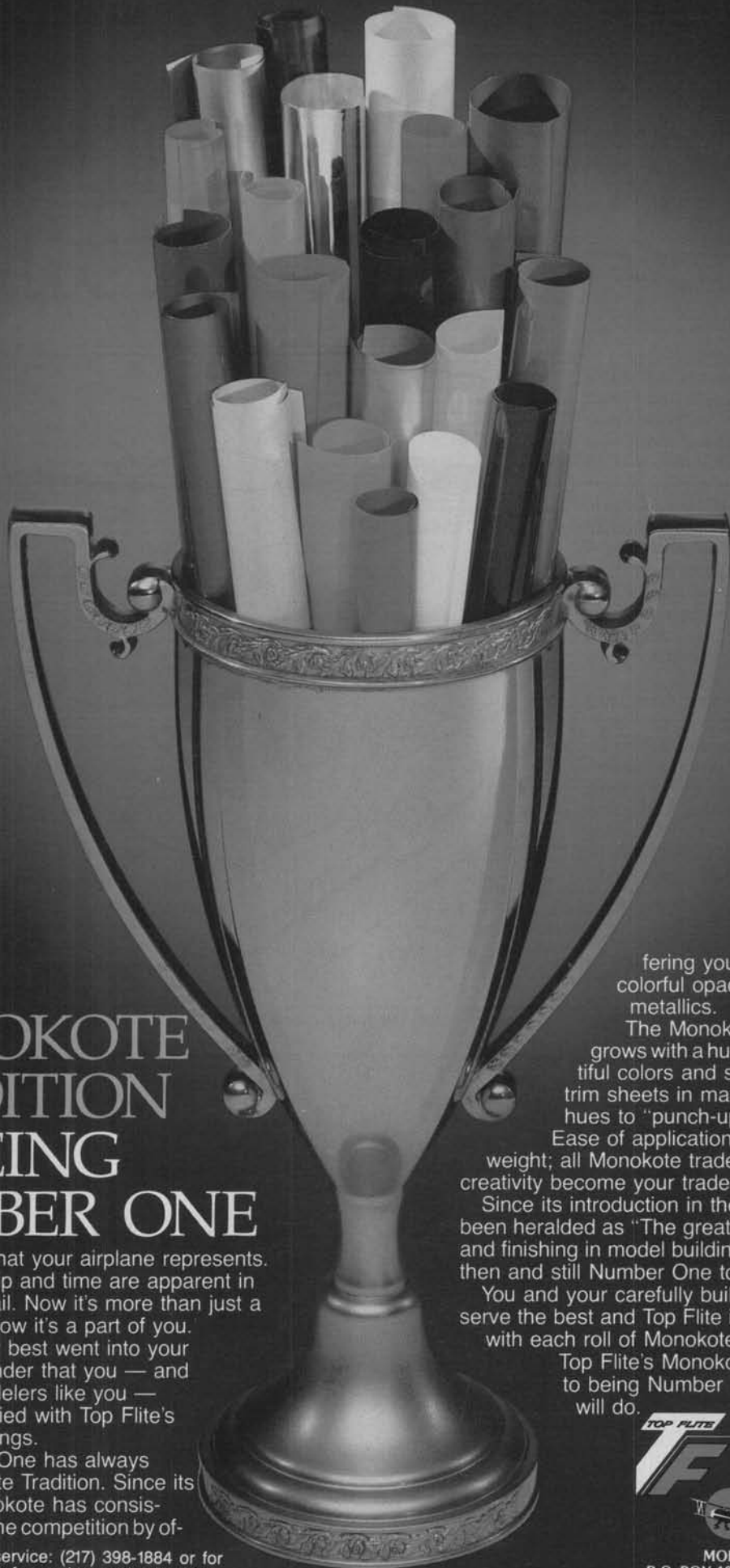
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BILL NORTHROP'S WORKBENCH

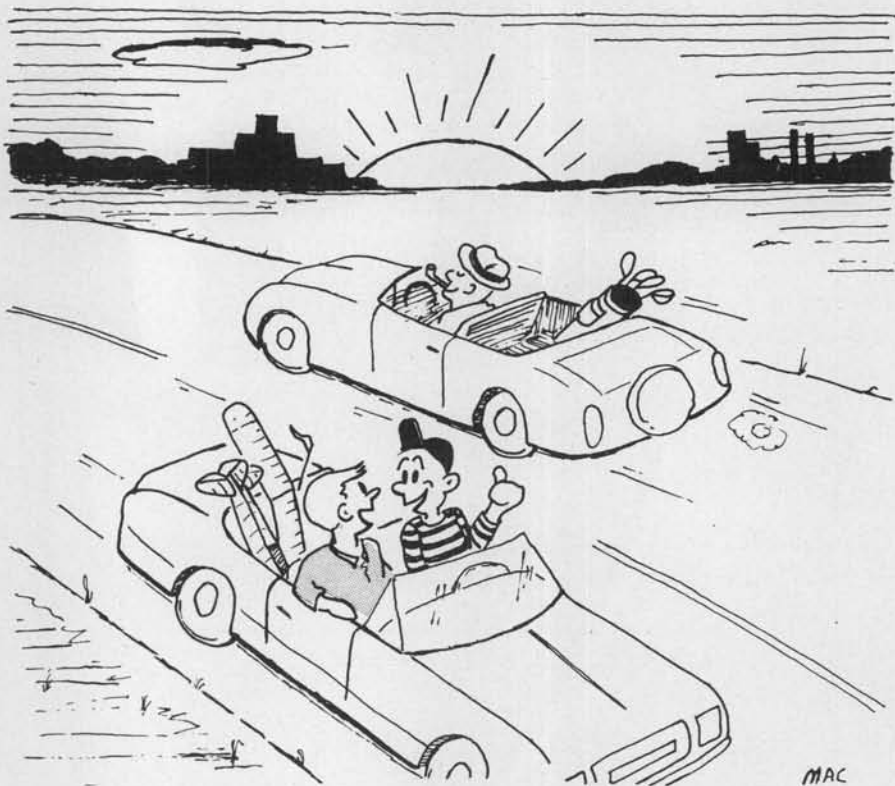
By the time you read this, our Model Builder Reader Survey will have been officially completed, as the deadline for receipt of qualified forms was March 31, at which time the names of 25 one-year MB subscription winners will have been drawn and scheduled for publishing in the July 1991 issue. (Keeping tenses straight can be a nightmare when you are writing in February for the May issue that appears in April and contains information about something that will take place the end of March and will appear in the July issue, which hits the newsstands in early June and is printed in May!)

Anyway, as of this moment, completed surveys have been coming in at an average rate of 22 per day, with a current total of 223. While complete analysis of the responses will take considerable time, there are some interesting statistics beginning to develop on subjects that relate to the model airplane hobby in general, and don't necessarily tie directly into questions asked about *Model Builder*.

The first one may be a shock to some, but no surprise to others, this writer included. Although the age bracket of 51 to 65 may have been too broad (the other brackets were 10-24, 21-30, 31-40, 41-50, and over 65), it nevertheless accounted for 51% of the responses, with "over 65" coming second at 17%, and "41-50" registering a close third at 16%. The "31-40" age bracket accounted for 10%, "21-30" counted 4%, and the 10-14 group was totally unheard from! It would be interesting to compare these figures with AMA's membership statistics.

Nearly all of the "65-plus" and quite a few of the "51-65" respondents are retired. This probably had only a slight lowering effect on the average yearly income of \$46,680.

The basic RC, FF, CL, and Static categories registered some interesting figures as the survey starts to build. Asked to specify choice of interest (not necessarily "active") by indicating 1st, 2nd, 3rd, and 4th choice, RC not too surprisingly registered 58%, FF was second with 36%, and Control line was 5%. For



What kind of a nut would get up at five a.m. just to play golf?



DUKE FOX DIES

DOn Thursday, February 14, our office called Fox Manufacturing Company, in Fort Smith, Arkansas, and learned that Duke Fox had been taken to the hospital, following a stroke. Today, the following Monday, when this is being written, we received a Fax message, announcing his death on Friday, February 15, 1991, at the age of 71. Duke had been suffering with heart trouble off and on for the past several years, but did not let this interfere with his devotion and involvement in the development and production of his well-known line of model engines . . . Duke and this writer had a long-standing debate on which neither of us would give in. He insisted that he was a manufacturer of "motors," while we held to the belief that they are "engines." Duke would always say, "Well, whoever heard of General Engines," which usually put an end to the discussion, at least for the moment.

The following information about Duke was included in the Fax message we received from the company.

continued on page 14



**ADVICE FOR
THE PROPWORN—
BY JAKE**

second choice, FF registered 36% again, RC scored 17%, CL 14%, and 5% indicated interest in Static (We're not sure if this is "Static Plastic" alone, or whether some modelers just enjoy building flying type models that are for display purposes only . . . like who would try to fly a 3/4-inch scale Cleveland model all decked out with opaque doped color and markings!?).

The last question we'll report on at this point was the one immediately following "choice of interest." This wanted to know in which categories the respondents were currently active. An astounding 47% indicated they are currently active in both RC and FF!

NEW SUBSCRIBER DEAL!

Now here's the kicker for readers of RCMB publications. In a drive to build up subscriptions, the company is offering special price incentives to attract new subscribers. Remember, this is for NEW subscribers only, and existing subscribers should understand that this effort is being made in order to improve our circulation, which in turn means that we will be able to continue to bring you the best in model hobby publications.

For *Model Builder* and also for *Radio Control Model Cars* readers, we are offering, for a limited time period, a one-year (12 issues) subscription for a special first-time subscriber price of only \$17 (seventeen dollars)! Turn on your brain, or your handy-dandy pocket calculator, and you'll quickly discover that this is one heck of a deal, especially when compared to the total newsstand cost for 12 issues! Not only that, the magazine(s) are delivered right to your doorstep every month . . . no chance of missing an issue!

Model boaters aren't left out of this either. First-time subscribers to *U.S. Boat & Ship Modeler* can also obtain a one-year (four issues) subscription for only \$10 (ten dollars), again at substantial savings when compared to newsstand cost.

Act now, and take advantage of these introductory offers to new subscribers. Do it today!

MB

Dear Jake:

Please excuse the pimento loaf stains, but I had a flash of inspiration that I just had to write to you about and the only paper I had available was my lunch bag. Pimento loaf is quite good, by the way. You should try it sometime.

Back to my inspiration. What if all scale modelers were required to build the same airplane to the same scale? Like maybe a 1/6-scale Pietenpol Aircamper. That way, whoever built the best one and flew it the best would win, and there wouldn't be any controversy over whether or not there should be extra static points for multiple engines or working toilets.

What do you think?
Burriss in Bennington, VT
Dear Burriss:

I think it's brilliant, but how about if the one chosen aircraft was an Airbus Industrie 300? Then everybody would have to build in the working toilets.

Jake

• • •

Dear Jake:

Is "Jake" just your pen name?
Milo in Merced

Dear Milo:
No, my pen doesn't have a name. I do call my favorite pencil "Cornelius," however.

Jake

• • •

Dear Jake:

Hi, it's me, Tommy Smith. Last weekend, after the paramedics left, my dad took me and my friends to watch my brother play in the junior hockey league.

I forgot I had a bottle of super glue in my pocket, so when my Milk Duds box broke, I poured them into my pocket to eat later.

When the second period started, I reached for a Milk Dud and pulled out a glued-together chocolate mess. It was sort of round and looked like a thick bumpy pancake. I tried to show it to Joey, but I dropped it over the rail and it fell onto the ice.

The players must've thought it was the hockey puck, because they started playing with it.

Just then, a player on the other team took a shot with it and my brother blocked it with his face. The whole gooey chocolate blob got glued to his cheek. The team trainer said

to leave it on there until the chocolate melted.

My question is this. Will debonder remove zits?

Your Friend, Tommy Smith
Dear Tommy:

No, but sandpaper will.

Jake

• • •

Dear Jake:

I read somewhere that Arnold Schwarzenegger likes to fly model airplanes. How come he talks so funny?

Curious in Concord, NH
Dear Curious:

Because English isn't his first language. Just like human isn't his first race.

Jake

• • •

Dear Jake:

I have run across the name Leopold Biffenstrecker several times in aviation history books, but it has never been clear exactly what his contribution was. Can you tell me anything about him?

Joel in Jennings, MT
Dear Joel:

Leopold Biffenstrecker was a pioneer in the commercial air transport area, ie. airliners. He invented or developed many of the conveniences we enjoy today.

You've probably seen those tiny liquor bottles. Well, Leopold invented them. He also invented the fold-down tray, plastic headphones, and the beverage cart.

Arctic wind air vents that blow your hat off, four and one half inches of leg room, and seatbacks that recline to within one inch of your upper lip are all also products of Leopold's fertile mind.

His most famous contribution, however, was the development of the hand gestures that stewardesses use when pointing out the exits. Those two-armed, four-fingered, closed-thumb ballets of the hand are the crowning achievement of Leopold Biffenstrecker's life.

Jake

• • •

Dear Jake:

Whatever happened to good taste in model airplane magazines? What became of the wholesome image of a boyhood hobby

continued on page 14

CONTROL-LINE HEADQUARTERS



KIT CL-21

MUSTANG STUNTER

Designed by MIKE GRETZ

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ENGINE: .20 - .40
WING SPAN: 50"



SKYRAY 35

KIT CL-25

Designed by MIKE PRATT

ENGINES: .19 - .35
WING SPAN: 44" **\$39.95**



TWISTER

KIT CL-22

Designed by MIKE GRETZ

\$39.95

ENGINE: .29 - .40
WING SPAN: 48"



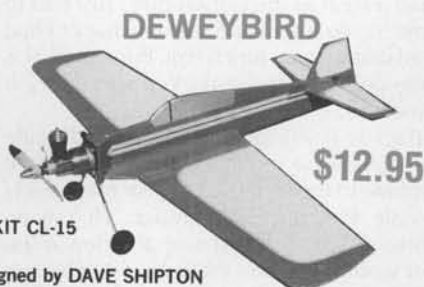
KIT CL-20

AKROMASTER

Designed by MIKE GRETZ

\$21.95

ENGINE: .15 - .19
WING SPAN: 34"



DEWEYBIRD

\$12.95

KIT CL-15

Designed by DAVE SHIPTON

ENGINE: .049 WING SPAN: 22-1/2"



KIT CL-19

SUPER CHIPMUNK

Designed by MIKE STOTT

\$62.95

ENGINE: .29 - .40
WINGSPAN: 53-1/2"



KIT CL-13

SHOESTRING

Designed by MIKE STOTT

\$19.95

ENGINE: .10 - .15
WING SPAN: 28"



SKYRAY

\$11.95

KIT CL-23

ENGINE: .049
WING SPAN: 23-3/4" Designed by MIKE GRETZ



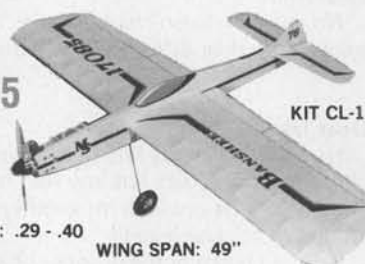
KIT CL-17

ENGINE: .049
WING SPAN: 18"

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Designed by MIKE STOTT

\$39.95



KIT CL-11

ENGINE: .29 - .40
WING SPAN: 49"

BEECHCRAFT STAGGERWING

\$13.95

Designed by MIKE STOTT

All prices subject to change without notice.



KIT CL-16

AKROBAT

Designed by MIKE STOTT

\$61.95

ENGINE: .29 - .40
WING SPAN: 51"



BUSTER

\$19.95

KIT CL-12

ENGINE: .10 - .15 WING SPAN: 24" Designed by MIKE STOTT



KIT CL-24

MAGNUM

Designed by MIKE PRATT

\$92.95

ENGINES: .40 - .60
WING SPAN: 60"

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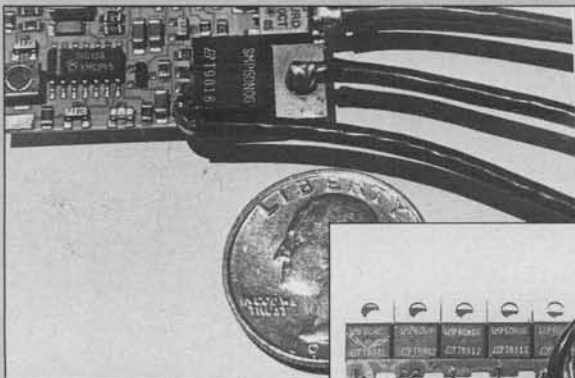
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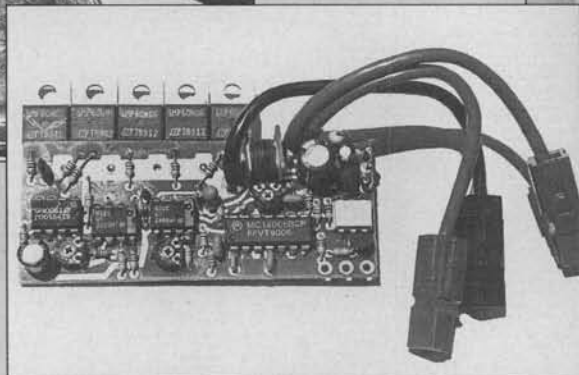
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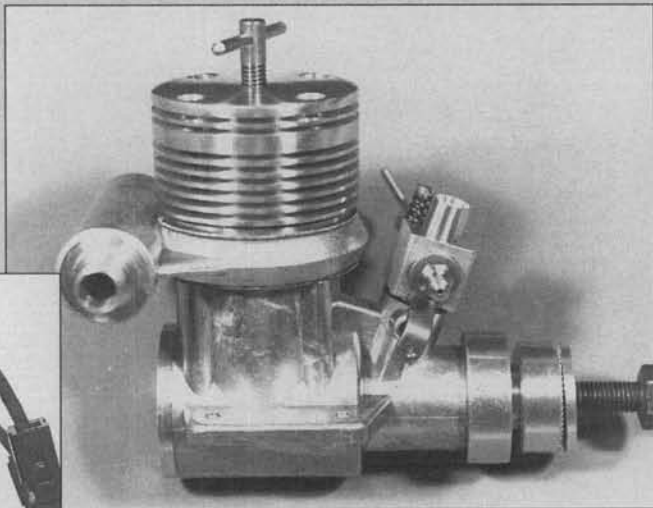


The "Eswitch" from Jomar.

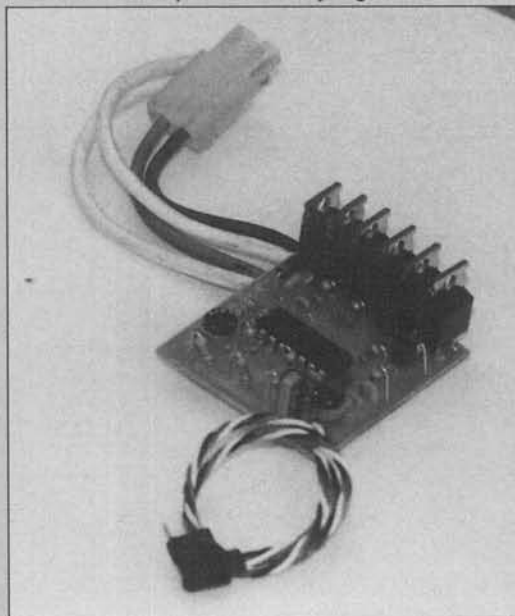


The SC-6 speed control from Jomar.

P.A.W. .35 RC twin ball bearing diesel, from Eric Clutton.



One of three new speed controls by Flightec.



The "Gambler 40" from Carden Corporation.



Carden Corporation, 1731 N.W. Madrid Way, Boca Raton, FL 33432, phone (407) 367-7744, is adding still another kit to its expanding line of RC model aircraft. Called the "Gambler 40," this latest offering is a sport/aerobatic design, as you might guess, for .40 to .45 two-

cycle or .40 to .53 four-cycle engines. Span is 56 inches, wing area is 630 sq. in., and flying weight is in the 5-1/2 pound bracket.

A typical Carden kit, the Gambler 40 is for those who build models rather than assemble, but the low parts count of high quality, hand-selected and matched balsa, plus precision-cut foam core wings and balsa skins, and top quality hardware, make it possible to build the ship ready for covering in eight to ten hours of construction time. Rolled plans and the detailed step-by-step instruction manual with photos complete the package. The list price is \$114.95, but the direct mail introductory special is \$79.95 plus \$5.00 shipping and handling. Check your dealer, or contact Carden at the above address or phone. And tell them where you

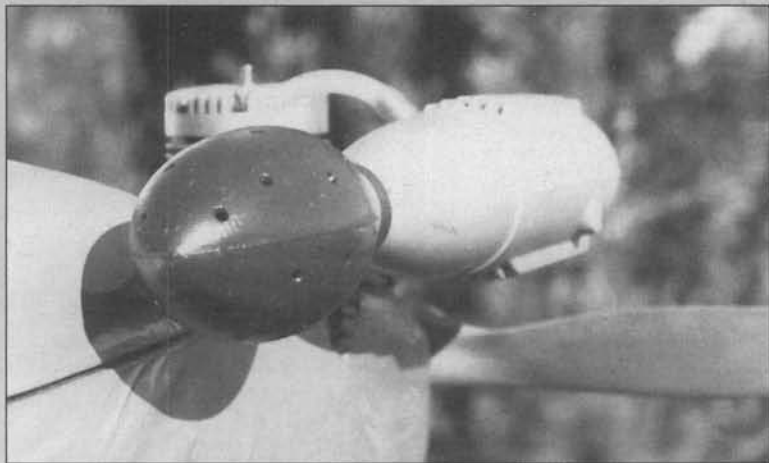
read about it.

• • •

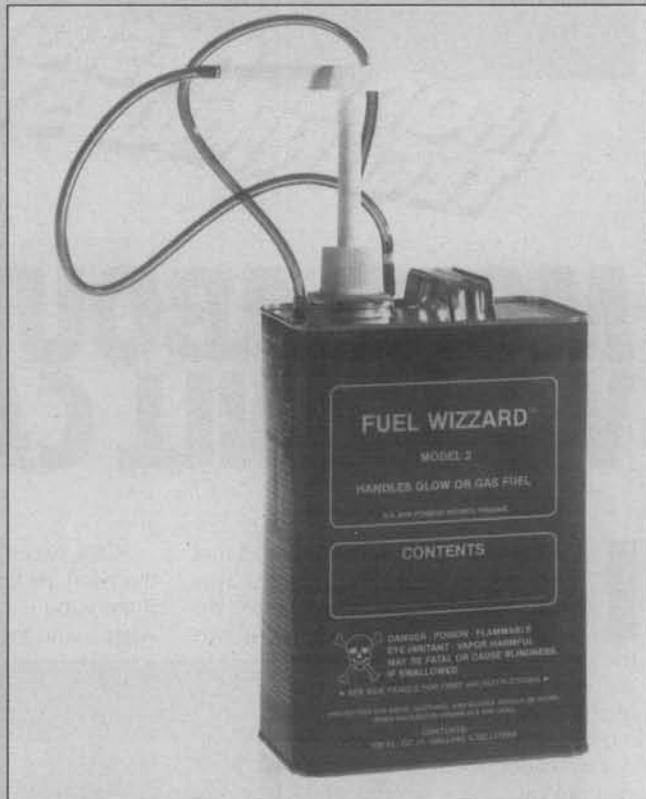
If you still haven't tried a diesel, and your curiosity is beginning to get the better of you, perhaps this is the time to make your move, particularly if you're a US reader, and have second thoughts about taking the trouble to order from overseas. P.A.W. diesels are distributed and sold in the US by Eric Clutton, 913 Cedar Lane, Tullahoma, TN 37388, along with a complete spares and service operation.

The latest engines from P.A.W. in England include a .29 and a .35, each available with twin ballbearing crankshafts. These engines feature balanced crankshafts and lightened pistons, providing very smooth operation and superb handling. With this introduc-

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 *MODEL BUILDER* does not constitute an endorsement of that product, nor any assurance as to its safety or performance.



KDI Rubber-After Muffler.



Fuel Wizzard can and pump by Sween i.d. Products.



Fast Start primer/additive by Sween i.d. Products.



Fast Clean for models, by Sween i.d. Products.



The Aeroindex, by Mark Fineman.

The "Hey Kid" book on basic aeromodeling, from Tab Books.



tion, all of the P.A.W. range is now available with a ballbearing option. The entire range, .049 to .35, is also available as C/L and R/C, with throttles that work very well, even in the small sizes.

Contact Eric at the above address, and get information on the full line of P.A.W. diesels.

• • •

Call it a "glow switch," call it an "electronic switch," call it anything you want, but don't call it to lunch . . . because it isn't human . . . it just replaces a servo and microswitch to turn on/off any type of electric accessory, such as a glow plug, a smoke fluid pump, lighting system, video camera, etc. The "Eswitch" is adjustable as to the turn-on point, as well as which direction of

transmitter stick travel turns the unit on. It can handle loads up to 12 volts and 10 amps as shown.

The Eswitch is built using surface mount technology on a ceramic substrate, and is built to "MIL-SPECS" to assure a lifetime of trouble-free operation. It is supplied with 15-gauge leads and Sermos connectors, you add your own receiver lead. Total weight is less than a half-ounce.

By now, you, and the manufacturer, are wondering if we're going to mention his name . . . well, we're gonna make you wait while we tell you about another new release from the same company. If you don't have it figured out by then, we'll let you in on the name.

The second new item is the SC-6 High

Power Electric Motor Throttle. It's designed especially for the 40, 60, and larger size electric motors, capable of handling from 12 to 35 cells at continuous currents up to 50 amps. Surge current rating is 250 amps. It is a "High Rate" control with special circuitry designed to minimize abrupt changes in motor speed. Exclusive "Up-Front" optical isolation keeps motor noise from getting to the receiver.

The SC-6 features five Siliconix SMP60N06 power MOSFETs and the SI9910 "Adaptive Power MOSFET Driver" chip which optimizes the control of the power MOSFETs to insure maximum performance and minimum power loss, and if you don't believe me, just ask Joe Utasi, at Jomar

continued on page 14

MORE ABOUT THE WINDMILL CAR

In the February issue we announced that the winner of the MD&TS contest was Will Kuhnle of Richardson, Texas. Up until that column went to press, Will was

the only reader to get the right answers and explain them correctly. Since then, I have received more answers, perhaps from two dozen readers total. All of them, except Will's, were wrong, until yesterday. That mail brought a letter from Leonard Duke of Kalamazoo, Michigan. You are right, Leonard, it **could** go into the wind and downwind faster than the wind. Congratulations! The score sheet proves it is a very tough little problem. I like Leonard's explanations, and quote him in part:

"Situation: A vehicle has a propeller which is turned by the wind. The propeller shaft can be geared to the wheels in any ratio desired. The cart has no energy storage system and is driven only by the wind. Question one: Can it move directly into the wind? Question two: Could it move downwind faster than the wind?"

"Case one: The cart being driven into the wind. Here the prop is being turned by the wind and using that force to turn the wheels. The force at the tires on the ground must be greater than the force of the wind on the prop, or else the cart will not be able to move into the wind.

"Thus the machine must be geared so that the propeller's force is multiplied at the tires. Since for any simple machine the only way to gain force is to lose distance, the cart's speed must be less than the speed of the wind past the propeller. Also, if it could move at a greater speed than the wind, it could be used as a perpetual motion machine in still air. In summary, the propeller would be turning quickly to turn the wheels slowly with a lot of torque. Wind turns the propeller which drives the wheels.

"Case two: Going downwind faster than the wind. At first glance this seems absurd. If the wind is turning the prop to drive the wheels and the cart were to approach the

be turning quickly to turn the prop slowly with a lot of torque. The prop needs to develop more thrust than the added drag on the tires.

"The cart speed added by the propeller turning against the wind must be less than the ground speed, because the prop is geared to turn slowly. Otherwise we again are attempting to invent perpetual motion. The wheels are exerting a force on the ground to slow the cart, but this force is exceeded by the added force of the propeller driving the cart downwind. The wind blows the cart, which turns the wheels, which turn the propeller (developing thrust) to increase the cart's speed."

Nicely worded, Leonard. You've got it. There are some of you who are not yet convinced, and may never be. I just got a letter from a reader in Connecticut who accused Mr. Kuhnle of pulling my leg. He thinks it looks like perpetual motion, especially Will's "Simplified Sailing Car" with flaps on the wheels (see February issue, pg. 48). It was obvious from the Connecticut letter that the writer hadn't really studied Will's sketch and its explanatory notes. No, no one is pulling any legs.

I am dropping the sailing vehicle here. I have no desire to promote another downwind turn debate. I found the little problem challenging and fascinating, as did many of you. I haven't figured out a practical application for it, however. Thanks again to all who participated.

MODELING MATERIALS

Balsawood has been used for building models for at least the last seventy years, and it is still the most common model airplane material. That says a lot about its suitability

continued on page 27



Merv Buckmaster's private modeling journals. See text.

windspeed, the prop would no longer have any relative wind to drive it. But what if the prop were being used to drive the cart by fighting the wind?

"Where will the torque to turn the prop come from? From the wheels being forced to turn on the ground. In this case the vehicle is a simple machine where the wheels will

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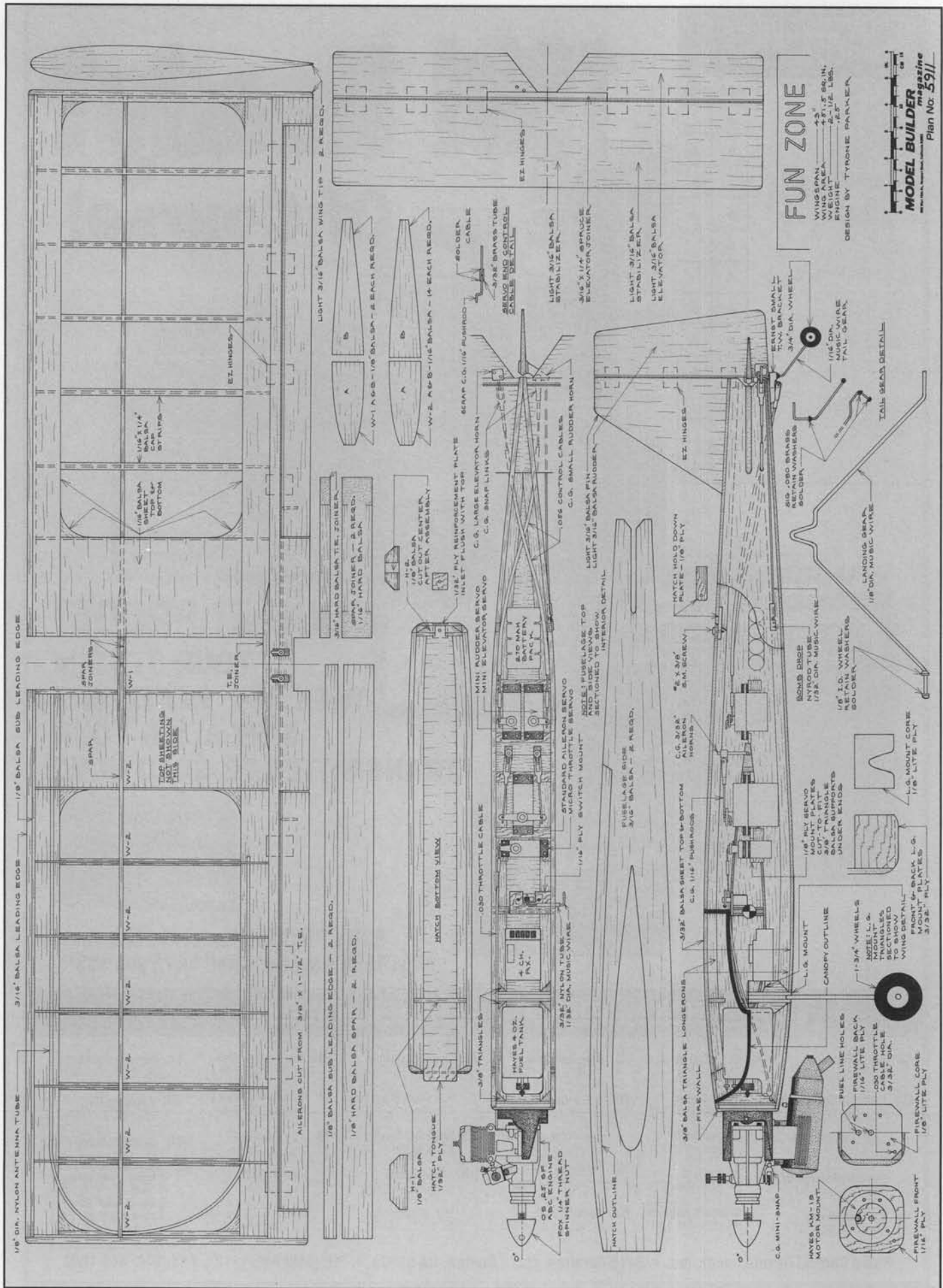
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 ENGINE 1/2" I.C.

DESIGN BY TYRONE PARKER



FUNZONE

BY TYRONE PARKER

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Begin construction with the wing. Cut sub-leading edge, spar, spar joiners, T.E. joiner and ribs to shape as shown on plan. CA spar halves together and attach joiners. CA trailing edge joiner to 3/8 x 1-1/2 inch trailing edge stock. Attach aft halves of W-1 ribs and W-2 tip ribs to spar and, taking care to keep it straight and even, attach trailing edge to ribs. Add remaining W-2 aft halves. Attach front W-1's and tip W-2's to spar front. Attach left and right sub-leading edges, then add remaining W-2 fronts. Use a sharpened 1/8-inch diameter brass tube to punch left wing ribs and spar tip to accommodate 1/8-inch diameter nylon antenna tube. Install antenna tube. Bevel sub-leading edge top and bottom to wing rib contour and attach leading edge sheeting. CA the 3/16-inch leading edge in place, round and sand smooth. Check that trailing edges of ribs are recessed 1/16-inch down from T.E. top surfaces. Trim T.E. sheeting to fit around T.E. joiner then CA in place. Attach center sheeting, cap strips, and fillets.

Using a balsa stripper or straight edge, cut

one inch from the trailing edge along its full length. Cut the ailerons from the strip you have removed. CA tip pieces back to trailing edge and attach 3/16-inch light balsa wing tips. Notch center T.E. section to fit aileron torque rods. Install torque rods and CA T.E. center section back in place. Slot and drill

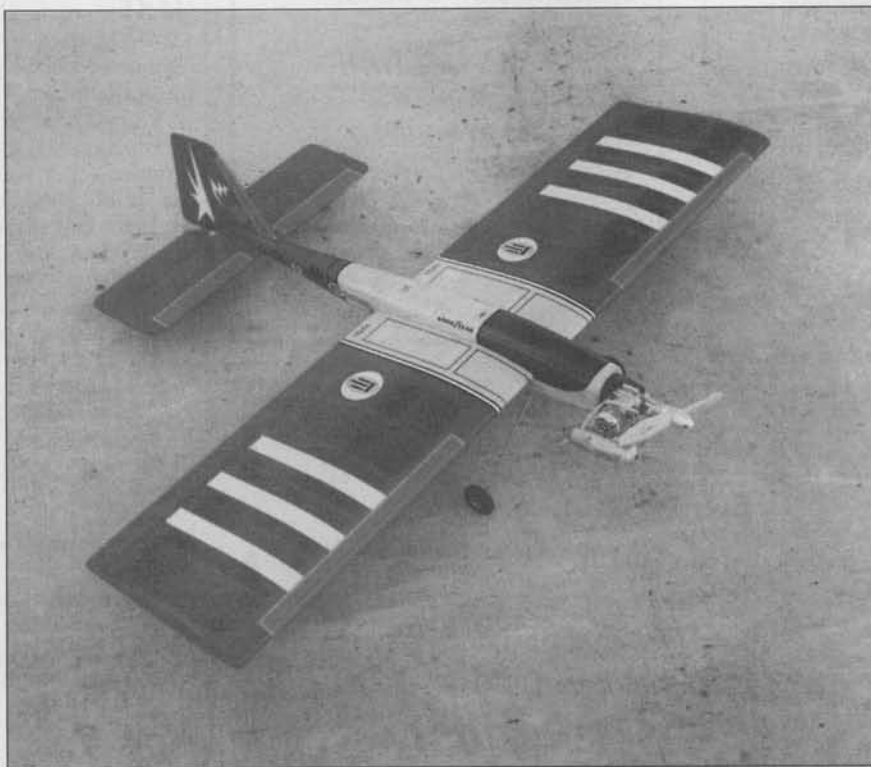
sides, CA tail ends together. Form landing gear from 1/8-inch diameter music wire. Cut L.G. mount front and back plates from 3/32-inch ply. Cut core from 1/8-inch lite-ply and trim to fit around gear. Laminate L.G. mount plates and core with CA. Notch fuselage bottom longerons to fit and CA landing gear mount in place. Trim front and back 3/8-inch balsa triangle L.G. mount braces to fit and CA in place.

Cut firewall front and back plates from 1/16-inch ply and core from 1/8-inch lite-ply. CA firewall back to core and CA firewall core and back in place at fuselage front. Bevel firewall core and back to fit fuselage top and bottom contours. Trim triangle firewall braces to fit and CA in place.

Plank fuselage top and bottom with firm but light 3/32-inch balsa. Mark hatch outline onto fuselage. Cut hatch loose along sides with balsa stripper and cut front and back loose with X-acto knife. Cut H-1 and H-2 to fit and CA to hatch. Cut hatch hold-down screw crush plate from 1/32-

inch ply, inset flush with hatch top and CA in place. Cut hatch tongue from 1/32-inch ply and CA in place. Cut hatch hold down plate from 1/8-inch ply and CA to fuselage. Fit hatch into place, drill and fit hold-down screw in place. Slot fuselage tail bottom to fit Ernst small tail wheel bracket. Round fuselage edges around T.W. bracket and sand smooth. Tack scrap 3/16-inch balsa to fuselage top where fin will be fitted, round

continued on page 67



aileron torque rod ends, bevel aileron front edges, then sand complete wing structure smooth.

Cut fuselage sides from firm but light 3/16-inch balsa and take special care to get a good fit around the wing. Slide sides back off wing and CA 3/8-inch balsa triangle longerons to inside fuselage tops and bottoms. Slide sides back onto wing and CA in place. Bevel inside fuselage tail section and taking special care to maintain even curves on both

DUKE Continued from page 4

"In California, back in the '30's, he saw the need for a light, powerful, RELIABLE model engine design, and developed the ORIGINAL Fox 35. This engine was the forerunner of the basic design that followed,

(a design) used by other manufacturers throughout the world. Duke's 'Fox 35' won, and is still winning, model contests. He built his first factory in California, and later moved to Fort Smith, Arkansas, where a better business climate existed. Besides the Fox 35, he manufactured several sizes of model

engines. Through the years, several hundred thousand Fox engines were sold.

"Perhaps the item that Duke is recognized most for is the Fox Glow Plug, which is the STANDARD of its field. Through the years, Duke developed several different styles of glow plugs that filled the exacting needs of the modeling public. Millions were made through the years.

"Duke Fox was honored by the Academy of Model Aeronautics in 1978, and was inducted into the MODEL AVIATION HALL OF FAME for the many contributions he made during the past 50 years.

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JAKE Continued from page 5

enjoyed in cheery workshops and in the great outdoors?

It's bad enough we have nymphettes on the covers and brazen hussies in the advertisements, but your column is the number one public offender with its endless stream of bathroom humor, risque remarks, and ethnic slurs. And Tommy Smith, who could be depicted as a classic example of American youth pursuing a time-honored pastime, is instead an abuser of domestic animals and mailmen.

Shame on you!

Deacon Coolidge, Halifax, TN

Dear Deacon:

Thank you for your support. I try to do my part.

Jake

Dear Jake:

You haven't taken any shots lately at Russian modeling. Have they improved or are you just cutting them more slack?

So what is the state of Russian modeling?
Jack in Jessica, LA

Dear Jack:

I would say Ohio. Specifically, the Cleveland area.

Jake
MB

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COUNTER Continued from page 9

Products, 2028 Knightsbridge Dr., Cincinnati, OH 452244, phone (513) 474-0985, 'cause I don't know what the hell he's talking about!

It is said that the Rubber-After Muffler by KDI is the best solution to two-stroke engine noise. It seems like the name should be Rubber After-Muffler, with the hyphen moved, as the KDI, which looks like a rubber squeeze bulb for fueling engines, but with holes punched in it, is mounted on the aft or exit end of the engine's metal muffler. Made from a silicone based material, it can withstand both the heat and chemicals from model engine exhaust. Available in two sizes, for .20 to .46 engines, and .50 to .90 engines, it can be obtained at concerned hobby shops or direct from KDI at 10426 SE 206 Pl., Kent, WA 98031. Call (206) 854-8083 after 1600 (4:00 pm) Pacific time for further information.

Flightec, 21 Juniper Way, Hamilton, NJ 08619, phone (609) 584-9409, has released three low-cost ESC (Electronic Speed Control) units which claim features found in units costing several times more. All three employ Hex MOSFETs for high reliability, lowest voltage drop, and thermal stability. All of the popular features are included, such as; dual adjustment pots, 2kHz high rate (frequency) modulation, proportional forward control, and compatibility with all major radio brands.

The SEC-I is priced at \$32.95 and is for use with stock/super stock motors from 6 to 14 cells. Voltage drop is 0.0083 volts per amp.

The SEC-II is \$39.95 and is for high per-

formance motors with heavy current loads, using 6 to 20 cells. The voltage drop is only 0.0045 volts per amp.

The SEC-L is \$34.95, and is designed to operate with low cell count, from only one, up to seven, for small 020, 035, and 050-powered aircraft and 1/12-scale cars.

For additional information, contact Phil Thayer at the above address or phone, and be sure to tell him you read about Flightec in *Model Builder*.

Sween i.d. Products, Inc., P.O. Box 8300, North Mankato, MN 56003, phone (800) 533-8543, is offering three new products based on gas-powered operation.

First there is the Fuel Wizzard Model 2, a completely assembled one-gallon metal fuel can and pump system that is compatible with glow, gasoline, and diesel fuels, as well as smoke fluid. The bright red-colored can is also marked with proper warnings and hazards printed in white, making it legal to store and transport any fuel, including gasoline.

Next there is Fast Start, available in two formulas, for getting those stubborn engines fired up when they begin playing games. The Gold formula is for use in cold weather, and the Green formula is for use in hot weather. A few drops in the carburetor just before propping the engine will do the trick.

At the other end of the accessory trip is Fast Clean, a combination of non-alkaline,

soapless cleaners and wetting agents for getting your model squeaky clean at the end of a day of activity.

For any further information on any or all of these items, contact Sween i.d. Products direct.

The "Aeroindex" is a unique compilation of all model plans published in *Model Builder* magazine since the first issue. The index is arranged chronologically from 1971 to the present, and includes every plan, whether a construction article, or simply reduced to fit the magazine pages. It is not just a full-size plans list; in fact, prices and ordering information are not included. Also not included are three-views of full-scale aircraft.

Four descriptive categories are given for every model: 1. The general type category of free flight, radio control, or control line; 2. Motive power, such as gas, rubber, electric, glider; 3 & 4 provide additional subdivisions such as competition, sport, scale, old-timer, indoor, Bostonian, boat, helicopter, trainer, etc.

The Aeroindex has been available for some time in print form, and still is, but now Mark Fineman, the creator of the index, has put it into computer form for IBM PC computers and 100% compatible models, on a 5-1/4 inch disc that includes a special browse utility and complete instructions. The price is just \$9.95, postpaid. The printed index is

continued on page 27



COMBAT MODELS

F-15 EAGLE

The Combat Models F-15 EAGLE is an injected molded .40-.50 sized pusher prop jet that can be built in about 8 hours. Aircraft grade very high density poly-styrene is what makes up the fast building sturdy 7 piece molded airframe. And for that realistic touch, a clear canopy, detailed cockpit, and jet pilot are all included. Building and flying are made easy with a colorful instruction booklet and video (incl). Bombs, missiles, external fuel tanks, pre-bent landing gear, and hardware are all included. Only \$73.95 + \$7.95 S&H Or buy the Video separately for \$11.95 + \$2.00 S&H

Wing span: 33" Length: 47" Engine: .40-.50 2 cycle

Slope Soarers- Mig 27, A-4 Skyhawk, and A-10 Thunderbolt. Only \$33.95 + \$4.95 S&H wood fuse, foam core wing & 1/64th ply (incl)

Mail checks or money orders to Combat Models 8525 Arjons Drive Ste. K Miramar, CA 92126 or call (619) 536-9922 with credit card number ready.

For more info, send self-addressed stamped envelope





'91 INTERNATIONAL MODELER SHOW REVIEW

What's new in sailplanes at the IMS Pasadena show out California way in 1991? Plenty, that's what. This reporter went armed with a single roll of 36-exposure B&W film, and much to my embarrassment, came back missing two shots for lack of film. No need to worry, though. Dick Dodd, of Dickybird Models, bridged the gap, and I now have the absolute maximum number of photos for the space of this column. Thanks, Dick.

I normally sort out and present the new soaring related products alphabetically starting with A. To be more fair to those companies falling towards the end of the alphabet, this year I'll start with Z and work backwards.

VS SAILPLANES

New this year in the VS Sailplanes booth were a couple of really slick slope soarers. The most visible from the isle was the rather smallish-scale Salto. With a wingspan in the six-foot to two-meter range (specs not available), this ranks as one of the smaller scale offerings in the world.

Control features are a departure from true scale, but are definitely in keeping with its light to medium lift, mild aerobatics function. This Salto features pitcherons or wingers (modeler's choice). With pitcherons, the wings function both as elevators (moving together) and as ailerons (moving opposite). In this configuration, the V-tail stabs are non-moving. With the winger option, the modeler may choose to have a separate elevator with pivoting wings for ailerons. All hard-to-find hardware items for either option are found in the kit box.

Other nice features include: seamless, one-piece molded, four-ply fiberglass/epoxy fuselage; integral wheel fairing; clear canopy; flat floor space for scale detailing; and molded-in centers for the wing rod holes, tail rod holes, and wheel axle holes. The wings are one-piece (right and left wing panels), blue structural foam core with pre-cut wing rod slots. The tail surfaces are sheet balsa and plug on using piano wire. The Salto kit is complete, containing all of the above plus: wing skins; all wood; full size drawings with construction notes; and metal stock.

Price for the Salto as of this writing is \$129.95 plus \$4.00 shipping. Contact VS directly for availability.

Next in line for the new mention is an aileron version of the popular Rotor. This new model is designed for the all-out slope racer or aerobat who prefers to work with the almost-conventional lite ply and balsa wood fuselage and stab materials, and obechi veneer over foam wing structures.

Also, the aileron version eliminates the need for the high-power servos required of pitcheron control. A low-mid-fin horizontal all-moving stab also eliminates the sometimes vulnerable T-tail design of the standard Rotor while giving separate elevator control.

Assuming the wings are the same taper and airfoil as the standard Rotor, the aileron version wing features an Eppler 374 airfoil thinned to 7.5% for reduced drag, a wingspan of 58 inches, an area of 305 square inches, and an aspect ratio of 11:1. Optional two-meter wings are also available which are a bit thicker at 9.5%.

The Aileron Rotor will run you \$119.95 plus \$4.00 shipping.

VS has the most complete information sheets I've seen for their sailplanes. Halftone photos, typeset type, three-views and aircraft silhouettes are just some of the professional things you'll find in each one. Collectively they form the VS Sailplanes catalog. I urge you to write or call VS and get a hold of one of these. I guarantee you it will be worth your time. VS Sailplanes, 2317 N 63rd, Seattle, WA 98103, (206) 525-5776.

VORTECH MODELS

This Long Beach, California, based company is the dream child of Jeff Fukushima, its designer and manufacturer (2032 San Anselme, Zip 90815, Phone [213] 594-9365).

New in Jeff's lineup is the F-15 Super Eagle. Featuring a fiberglass fuselage and foam core wings, the avid slope ace can't go wrong ordering one of these. The wingspan is 45 inches, the length is 46.25 inches (yes, it is longer than wide), and the flying weight is 50 ounces. Standard radio gear will fit.

The little BD-5 "Coors Silver Bullet" look-alike plane Jeff is holding in the photo is in

fact his E.D.B.D. (sounds like itty bitty). I can't explain the landing gear visible on this slope glider, but I can tell you it has a fiberglass fuselage, foam core wings, a wingspan of 46 inches, a length of 22 inches, and a flying weight of only 17 ounces (with mini radio).

Also new this year is Jeff's V-1 Viper. Although this one isn't a scale model, it definitely is a fun one. Features include: fiberglass fuselage, 54-inch wingspan, 33-inch length, 26-ounce flying weight, and room for standard radio gear. Slope aerobatics is the V-1 Viper's long suit.

Contact Vortech directly for additional information. Also available are a P-51 and a Zero.

UNITED STATES FAI/F3B TEAM

New products, as relate to our national team, are fund-raising in nature, not for anyone's personal profit. Joe Wurts, therefore, is more interested in representing you as a team member in Holland this year than just making a buck. What he is showing you are T-shirts, caps, patches, and pins, each with the official symbol of the USA F3B Team.

It is a very expensive undertaking to get a sporting team like this to another part of the world. Transportation, lodging, food, incidentals, they all cost plenty. Yes, AMA helps fund the team, but only partially. The rest comes from you and me. Please chip in.

Raffle entry tickets are \$10.00. Small, medium, large, extra large, and even XX large T-shirts are each \$12.00. The official team pin costs \$3.00. The official team patch costs \$5.00. For shipping and handling add 10% of the order. Any straight donations are also quite welcome, naturally! Send to: 1991 USA F3B Soaring Team, P.O. Box 3242, Lakewood, CA 90711-3242. Please allow three weeks for delivery.

SLOPE SCALE

Brian Laird certainly has a bunch of warbirds to offer the PSS (power scale slope) fanatic. Me-109, Zero, P-63 King Cobra, Spitfire, P-51, F6F Hellcat, FW-190, and now it looks like there will even be a P-38 Lightning!

Showing his kit prototype, Brian was interested in obtaining feedback from So-Cal



VS Sailplanes' new Salto slope scale offering. Features pitcheron control.



Brian Laird and his pretty, new P-38 Lightning PSS ship prototype. Available soon.

The new Milo Products Pilatus B-4 two-meter for aerobatic slope flying as seen in the American Sailplane Designs booth.



Jeff Fukushima and his newest offerings (top to bottom); the V-1 Viper, the F-15 Eagle, and the E.D.B.D.



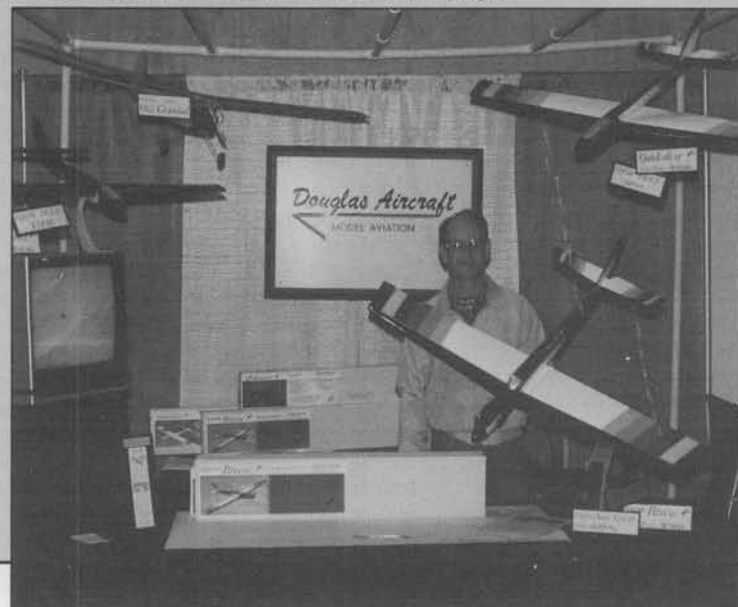
The U.S. FAI/F3B Team (L to R): Randy Spencer (TM), Daryl Perkins, Larry Jolly, and Joe Wurts. The best, most friendly team yet, and one that will well represent our nation.



Mike Pratt in the Sig booth with the prototype, no-name-yet slope glider with pitcheron control and V-



Doug Hertzog of Douglas Aircraft with his new electric powered sailplane called the Breeze. Based on his popular Quicksilver slope glider.



This is truly a glider, not a ducted fan model! This Gates Learjet partial kit is a biggie at 1/8 scale.

Dynaflite's Apogee Electric. New 7-cell electric version of the popular competition sailplane now with ailerons and flat wings. Bird of Time, above Apogee, still a favorite with many, designed by Dave Thornburg.



PSS'ers which would influence his decision to go into production. His opinion was that indeed there is sufficient interest to warrant a kit, but that due to the complex nature of the model, it would probably hit the \$150 to \$170 range. This would include a fiberglass fuselage pod, booms, nacelles, and balsa sheeted foam core wings.

If you want to get a kit from the first run, contact Brian at: 12935 Lasselle St., Moreno Valley, CA 92388, or call (714) 924-8409.

SIG MANUFACTURING

Sig's big success with its Ninja slope glider has prompted yet another slope design which is currently under consideration as a possible kit. As yet unnamed, this prototype was on display at the Pasadena IMS show to obtain public feedback.

Mike Pratt, designer of both gliders, says the latest design has a span of 68 inches (ten more than a Ninja), an area of about 470 square inches, the RG-14 airfoil, a 10.5 ounce wing loading, a fixed V-tail, a 34 ounce total weight, and foam core wings with 5/16 joiner rod. The latter is needed to allow for pitcheron control. All details have not yet been worked out, so an expected release date and price are not available.

(Unfortunately, the photo doesn't distinguish between the black Ninja background and the black tips of the V-tail of the new glider. The V-tail is a little larger than it appears, and it has squared off tips like the wing.)

Contact your local Sig dealer or Sig directly for further details.

MILO MODEL PRODUCTS

New this year in the American Sailplane Designs booth were a couple of exciting new products, the most impressive of which was a giant, 1/8-scale PSS Gates Learjet Model 35. Spanning a normal enough 65 inches, this biggie turns out to be a full 68 inches long with a 626 square inch wing! All up weight is estimated at 5.25 pounds.

The Learjet features molded fiberglass fuselage, fiberglass engine nacelles, vacu-formed plastic wing tip tanks, and foam core flying surfaces. Being a partial kit, no balsa sheeting or hardware are included. Half-size plans and some instructions are included, however, and it all goes for a reasonable \$275.00.

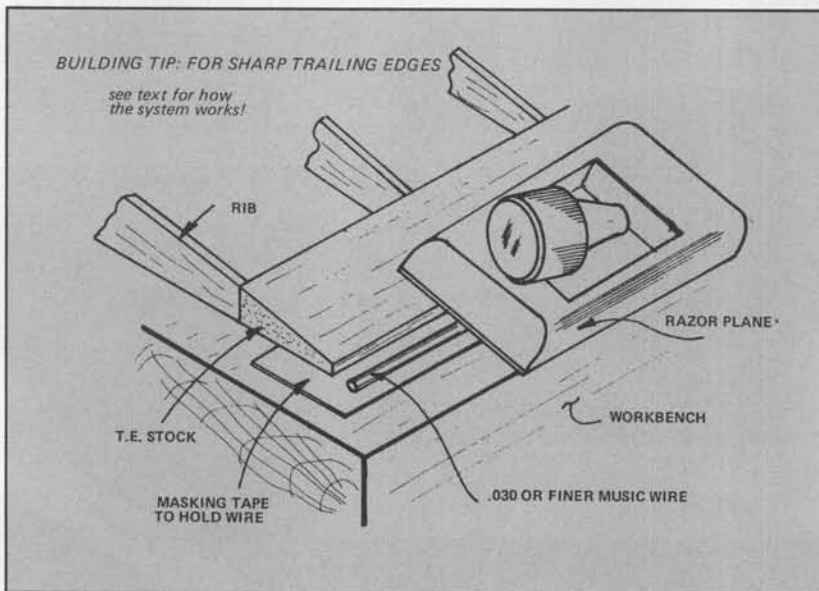
Also in the Milo/American booth was the new Pilatus B-4 scale slope ship. The kit features a fiberglass fuselage, clear canopy, molded ABS cockpit, foam core wings, and balsa sheet tails. The kit is designed for three channel operation: pivot wings (wingers), rudder and elevator. Full size plans and written instructions are included. Specs are: span, 2 meters (78in); wing area, 412 square

inches; airfoil, Eppler 205. The selling price will be around \$125.00.

Milo Model Products are distributed by American sailplane Designs (619) 429-8281 and Northeast Sailplane products (802) 658-9482. Contact these two sources for further info.

KNIFE EDGE TRAILING EDGES MADE FAST AND EASY

Pete Young of Garden Grove, California, sends in a handy tip for making aerodynamically superior, thin trailing edges. He claims the method is "fast and easy," and is nearly foolproof and dust free.



The method involves using K&S music wire of .030" or finer as a guide for a razor plane. Simply use masking tape to hold the wire up tightly against the aft edge of the TE. Plane the balsa or hard spruce TE stock down to the wire. The wire provides a hard point that you can't cut past. The TE comes out very uniformly shaped and as thin as the wire itself. Finish sanding is all that remains, followed by a thin coating on thin CA glue to harden the soft balsa against minor bumps and hanger rash.

DYNAFLITE

Lovers of electric powered motorgliders will be interested in the latest offering from Mark Smith and company down at Dynaf-lite. It is the Electric Apogee, a seven-cell version of the Apogee sailplane.

The principle differences of the new versus the old are (obviously) the electric motor in the nose (as opposed to the electric winch on the ground for the sailplane version), and the flat wings with ailerons.

The sign reads "Available Soon." This means by the time you read this, the Electric Apogee might be ready to buy. Contact Dynaf-lite for further details (P.O. Box 1011, San Marcos, CA 92079, (619) 744-9605), or ask your favorite Dynaf-lite dealer for a look at the kit.

DOUGLAS AIRCRAFT

Doug from Douglas Aircraft displayed his latest creation at the IMS, namely an electric powered sport sailplane based on his popu-

lar Quicksilver aerobatic slope ship (background in photo). The Breeze, as it is called, is intended for seven-cell "05" class motors and is just as aerobatic as its ancestors in the line. The wing uses the modern Selig-Donovan SD6060 airfoil for best performance either inverted or rightside up. Doug claims that with a good ferrite motor/battery/prop combo it will even do an outside loop. And with a cobalt magnet motor "you will be truly amazed!"

The kit is very complete including all wood and foam cores ready for assembly. A minimum of three channels are required: aileron, elevator, and throttle. The wingspan is 52 inches and the area is 362 square inches. The suggested retail price is \$79.95, and it is available direct or through select retail outlets. Contact Douglas Aircraft if you need further info: P.O. Box 92472, Long Beach, CA 90809, (213) 498-1737.

DICKYBIRD MODELS

Not only are we looking at new models, but also a new company! Stuart Hamill and Dick Dodd were kept very busy at the IMS answering all kinds of questions about the many new things in their booth. Of particular interest to readers of this column were the ARF gliders and ARF

motorgliders.

The "Battle of Britain Warbirds," including an Me-109 and a Spitfire, are electric powered models which take PSS a step further. With spans of 60 inches, areas of 420 squares, lengths of 34 inches, and flying weights of 44 ounces as electrics, these models can be flown successfully as powered models from the slope when the lift is light, or flown as sailplanes too. As sailplanes, these same models weigh only 27 ounces.

The Me-109 and Spitfire come with vacu-form plastic body and tail pieces, full decals, machine cut balsa stabs, prefab lite ply and balsa fuselages, prefab balsa sheet wings, and unique Dickybird Hi-lift airfoil (like a Jedelsky wing). From the literature I collected, I am not sure what if any propulsion parts are included. Price for either model is \$98.00 plus \$4.00 shipping, and California sales tax (if applicable).

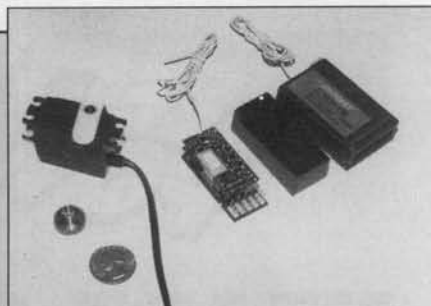
Dickybird's "Classic Gliders of the 1930's" have a unique old-timey look that many will find attractive. Intended for slope or hi-start flying, these models include the British Kirby Kite and the German Grunau Baby. Construction features include prefab balsa sheet wings, prefab balsa and lite ply fuselages, vacu-form plastic body pods, and optional spoilers. The spans for each are 72 inches, lengths are 31 inches, areas are 390 squares, and flying weights are 27 ounces. A two- or three-channel radio is required. The sug-

continued on page 75



Stuart Hamill and the Grunau Baby with Kirby Kite and Me-109 sloper/electric in the background. ARF construction and solid balsa flying surfaces.

(L to R) DCU's Mark Hamill and Dan Danrich holding models of mutual design: Wind Weasel V-tail and Wind Warrior slope racer.



New from Airtronics is their 4-channel Micro FM/PPM receiver shown here with the 8-channel PCM receiver and the new 94161 PRO Series giant scale ball bearing metal gear servo.



Finally in production and available: DCU's F-14 Tomcat PSS'er. Really an eye catcher!



Byron Bruce of Combat Models with his molded high density foam F-15 Eagle warbird. Intended for .40-.50 power, can also be converted to slope soaring.



Robert Pettyjohn and the new Lynx from Cheetah Models. Features foam core wings, balsa fuselage and tails.



Larry Pettyjohn recommends this style of servo hatch for direct drive aileron control on the Lynx. The hatch is held in place by cellophane tape, the servo is held in place by balsa triangles and the skin of the wing's upper surface (it is trapped). Allows near-instant servo swaps.



"Now if you are a good boy, I will let you buy my glider," is what Katie Martin seems to be saying about the new Katie II.

Arnold at AMS Imports shows just how big a 2.75m glider wing can be out of the box. Pilatus B-4 is an aerobatic scale ARF ship with spoilers.



HEART & SOUL OF MOTORS



Kinda reminiscent of the familiar Fleet biplane, is the original design "Grandson" by Elis Grumer. Dummy radial engine is quite simple but adds much to the overall effect.



Another of Elis Grumer's attractive bipes is this colorful Astro 40 powered by Curtiss Seagull. Photo taken by Fred Sauerberger at last year's KRC meet.

I must be having fun, because the time flies! About a year ago I described Ed Westbrook's simplified method for determining the resistance (R) and speed constant (K) for a motor. Those who read the column regularly already know that R and K are the "heart and soul" of a motor. From them, you can calculate the motor curves, power efficiency, best operating voltage, best prop, current, and maximum power output. It means you can tailor the motor to the plane without hours of bench testing or test flying. I personally have found this to be a tremendous help. It solves the "what is it?" dilemma presented by a new motor.

Ed's procedure is very simple: hook up a DVM to the motor terminals, and spin the motor with an electric drill or drill press. Record the voltage generated by the motor in this no load condition. Then put an ammeter across the terminals of the motor, and spin it again with the drill press. Record the voltage and amperes. Use a tachometer to get the rpm of the drill when it is spinning the motor. The speed constant is the no-load voltage divided by the rpm of the drill. The resistance of the motor is obtained by subtracting the loaded (ammeter) voltage from the unloaded voltage, then dividing the result by the amperes recorded in the loaded

test. This is a very fast procedure, and I ran it on eleven motors in less than an hour and a half!

Last year I tripped myself up, however. I got innovative, and used a Mabuchi 540 motor to spin the motors I was testing. Big mistake! The result was that the Mabuchi slowed down when the ammeter loaded the test motor down, and I didn't get a speed constant (K) or resistance (R) that checked with the ones I got by using propellers (simultaneous equations). Ed patiently pointed this out, and this time I did it right. I used a Skil 1/3 horsepower hand drill to do the spinning, and this time the K and R checked very well with the ones I get with propellers. This drill does not slow down

under load! As Ed pointed out to me, the unloaded and loaded tests must be done at the same rpm.

This procedure needs very little special setup: I have a stand so that the drill can stand vertically, and two strips of white tape on the black chuck body so the optical tachometer can count rpm. I have tested motors with the drill horizontal, but this creates some side loading on the motor bearings. This makes the readings go up and down, as K is very sensitive to friction. With the motor hung vertically below the drill, I hold the motor with my fingers so that it will not spin. This has worked fine with motors up to 40 size. You must have a DVM to read the voltage; most of the time it is below one volt and under load it is usually below a tenth of a volt. An analog ammeter is adequate provided it can handle up to 20 amperes, but a digital ammeter is best. I use a shunt and the 200 mv scale on my DVM to read amps; the sketch shows how. My DVM can read 10 amps; I used that to calibrate the shunt.

This test method is Ed's favorite, and it is rapidly becoming mine too. It is very simple, very fast, and the math is easy! The simultaneous equations method takes more testing time, the math is slower, and it is not quite as "clean," since the R and K affect each

TABLE 1.

Motor	K (volts/krpm)	R (ohm)
Mabuchi 540 VS (Whisper helicopter)	0.312	0.056
Kyosho 360PT	0.316	0.073
Mabuchi 550 (from surplus store)	0.514	0.365
Leisure Modified 05	0.308	0.055
Mabuchi 540 (1981 can motor)	0.417	0.161
Robbe/Keller 540T (neodymium)	0.358	0.147
Marc 300/10 (neodymium)	1.080	0.236
Astro 05 Turbo (cobalt)	0.315	0.057
Astro 05 (cobalt)	0.468	0.097
Astro 15 (cobalt)	0.804	0.151
Air Supply 05 (cobalt)	0.304	0.091

other. The "spin up" method allows independent R and K determinations. I recommend the "spin up" testing, it is fun to do!

Here is the data for the Kyosho LeMans 480 Gold motor: No load = .74 volt, under load 0.036 volt and 7.6 amperes. The drill speed was 2180 rpm. This gives a K of 0.339 volts/krpm (krpm = 1000 rpm) or 0.000339 volts/rpm. R is 0.093 ohm. I got 0.350 volts/krpm and 0.090 ohm from independent testing using propellers as loads and simultaneous equations, so you can see the results are very close. As mentioned, I got test happy and ran eleven motors after that. The

the motor zero at no current. This effect is important only at currents below about two amps, and the simple setup I have just described will do fine for evaluating motors. Thank you, Ed!

You have just been given some powerful tools. Now you can evaluate any motor easily. Fly high!

Jim Martin of Hobby Lobby sent photos and info on additions to his extensive line of electric supplies. The Hobby Lobby catalog number 17 is free . . . just write to Hobby Lobby at 5614 Franklin Pike Circle, Brentwood, TN 37027. Hobby Lobby now has

The info sent me says it is a 3000 watt motor, however, I think in practice it is usually run at 800 to 1800 watts. That is still a lot, up to two horsepower. The usual supply is 27 cells . . . though I have seen it perform in helicopters with thirty cells very well. It weighs 24 ounces and is just under five inches long. The performance I saw in a helicopter, at 11 lbs. flying weight, was very good, like gas type flying. It was the motor powering the winning FAI F3E plane in Austria last summer. Price is \$499.

Good news for "schoolyard fliers!" I have had several letters asking for a source for a



Astro 60 powered Ultimate 10-300 was a real crowd pleaser at the KRC meet. Chris True built it from the Carl Goldberg kit with no major changes. Gotta get some different wheels for it though, Chris, those spokes just don't cut it.



Bob Runsey modeled some Reno "heavy metal" in the form of this Astro 60 powered Tsunami unlimited racer, based on a modified Marks Models kit. Sure looks fast!

results are shown in table 1.

Have fun with these! I like to plot voltage, torque, power out and % efficiency vertically, and rpm horizontally. Pick the number of cells you want to use, and calculate the actual voltage the motor sees using 1.25 volts per cell, 0.012 ohm resistance per cell, and .03 ohm for the wiring harness (fuse, switch, connectors, and wire). For a seven-cell pack, this is a total of $7 \times 1.25 = 8.75$ volts and $7 \times 0.012 + .030 = 0.114$ ohm resistance. Calculate the values in steps of current (I). Five ampere steps work out well from 0 to 35 amperes. For the seven-cell pack, the values will be: $V = 8.75 - 0.114 \times I$, Power In (watts) = $V \times I$ Power Out (watts) = $V \times I - I^2 \times R$, % efficiency = $100 \times \text{Power In} / \text{Power Out}$, RPM = $1000 \times \text{Power Out} / (I \times K)$, Torque (oz.-in.) = $1350 \times \text{Power Out} / \text{RPM}$. Note: K is in volts/krpm in these equations.

Those of you with computers will find this easy to program. It is very interesting to try other cell counts and find the "best" match of cells to the motor in terms of efficiency and power output. Note: I have left out something called "loss resistance." The motor is spending power just to turn itself. This can be about five watts. This makes the efficiency of

the big Plettenberg motor, the Hectoplett 355. I think it has the neodymium magnets.

Ken Stinson's interesting "Fantrainer 600" features an Astro 05 Cobalt turning three stacked 6x4 props inside an abbreviated shroud. Ken scaled up the plans from a smaller 1/2A model.



gear unit for the small motors, those in the 30 to 50 watt size. Hobby Lobby now has the Mini Olympus electric drive, which is a 2.3:1 gear drive with a 380 motor included. It is 3-1/4 inches long, and weighs 3-1/3 ounces with the motor. The recommended prop is an 8x6. The drive can be mounted on beams. I see no provision for firewall mounting, though I'll bet it would be easy, just by gluing some wood blocks on the drive gear housing. I'm guessing from the photo, but it appears to be made of fiber reinforced plastic, which should be pretty tough. The price is \$22 . . . very reasonable considering the motor is included too. I think the Highline 30 and 50 watt motors would fit this drive too.

Hobby Lobby is selling the TRC Impulse 4 charger, which can automatically peak charge 1 to 18 cells. I have had my Impulse 4 for four years now and am very pleased with it. The peak detector is special in that it detects the point at which the charge current stops increasing. This corresponds to the top of the voltage peak. Other chargers detect the drop in voltage after the peak, which causes heating of the battery packs. For a gentle peak charge, I believe the TRC is the best. The Hobby Lobby info

says the charge rate ranges from 1.5 to 6.5 amps. My Impulse 4 is very constant current. On the low rate switch, it is 1.5 amps for most packs throughout the charge. On the high rate switch it can range from 4.5 amps at the start to 3.5 amps at the end of the charge, on any pack up to 18 cells.

I have had only one problem with the Impulse 4, and that was easily fixed. There is a small relay that is glued by its cover to the bottom of the charger box. The relay cover popped off and the charger would not charge. The fix was simple: I pried the cover off the box and taped it back on the relay. I did not glue the relay down; that is what let the cover pop off. I have had no problems since. The charger does have a high pitched noise that I do not like, so I run it when I am not in the workshop. It has been very reliable, very versatile, and I recommend it. It is \$158 from Hobby Lobby. Thanks, Jim, for the info!

I have more photos from the 1990 KRC meet, thanks to Fred Sauerberger. Elis Grumer's "Grandson" biplane is a cutie in red, white and blue. Elis has a long list of biplanes to his credit in past years; I think he has published at least one ("Grandma," in *Model Aviation*). The Grandson is powered by a geared Astro 15 cobalt motor turning a 12x8 prop. Flying weight is 5 lbs., the battery pack is fourteen 900 mA cells.

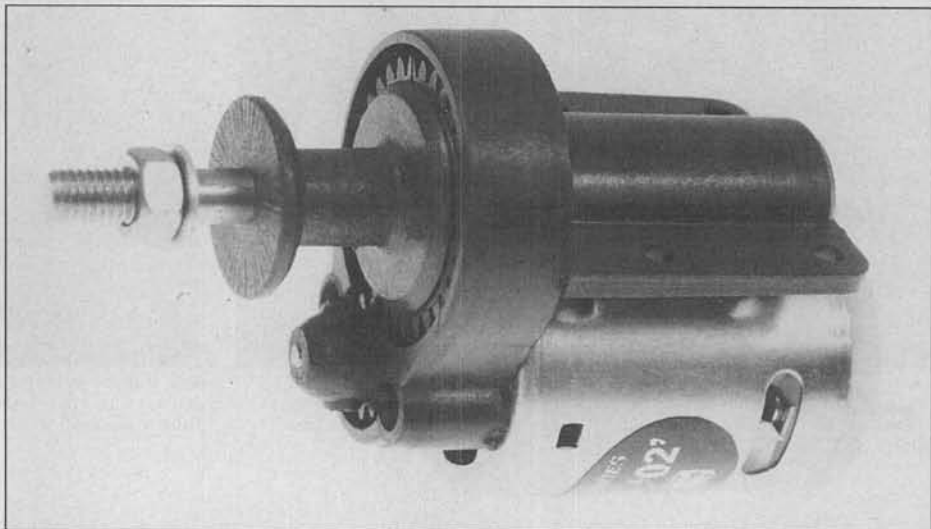
The Curtiss Seagull by Elis is a lovely 1930's scale Navy plane, powered by an Astro 40 cobalt motor. It uses twenty-one 900 mA cells and weighs 9 lbs. Span is 5-1/2 feet, giving a very low wing loading of 14.9 oz./sq. ft. Nice work, Elis. Here's hoping some of these appear as articles!

Ken Stinson had a very attractive ducted fan model, the Apex 417 Fantrainer 600. It is 40 oz., powered by an Astro 9-turn Cobalt 05 on eight 1200 mA cells. The throttle is a Jomar SC-4. The prop-fan is three Cox 6x4 props stacked together. Ken scratch-built this plane, using scaled up plans originally published in *Model Airplane News* for 1/2A power. The flight on video looked very good.

Chris True tackled a big project, an electric version of the Carl Goldberg Ultimate 10-300 kit. He used an Astro 60 cobalt powered by twenty-nine 1.2 SCR cells . . . handled by a Jomar SC-6 throttle. Flying weight is 10-3/4 lbs. The kit was built as is, with no modifications. The video I saw showed a very good flight, no problems. I think this was only the second or third flight. It is a very racy looking biplane, in dark blue and yellow. The full-scale "Bluehawk" is a competitive aerobatic machine.

Bob Runsey's Tsunami is a scale model of the Reno racing machine. The full-size Tsunami, despite its resemblance to the P-51, is an original design, built from scratch by its racing team. Bob built his model from the Marks Models Phantom kit (no longer available, I think). It is powered by an Astro cobalt 60 on twenty-eight cells handled by a Jomar SC-6 throttle. It weighs 9 lbs. and has 815 sq.in. of wing area. It looks very good in silver and blue trim. Nice work!

The Astro Cobalt 60 has, without ques-

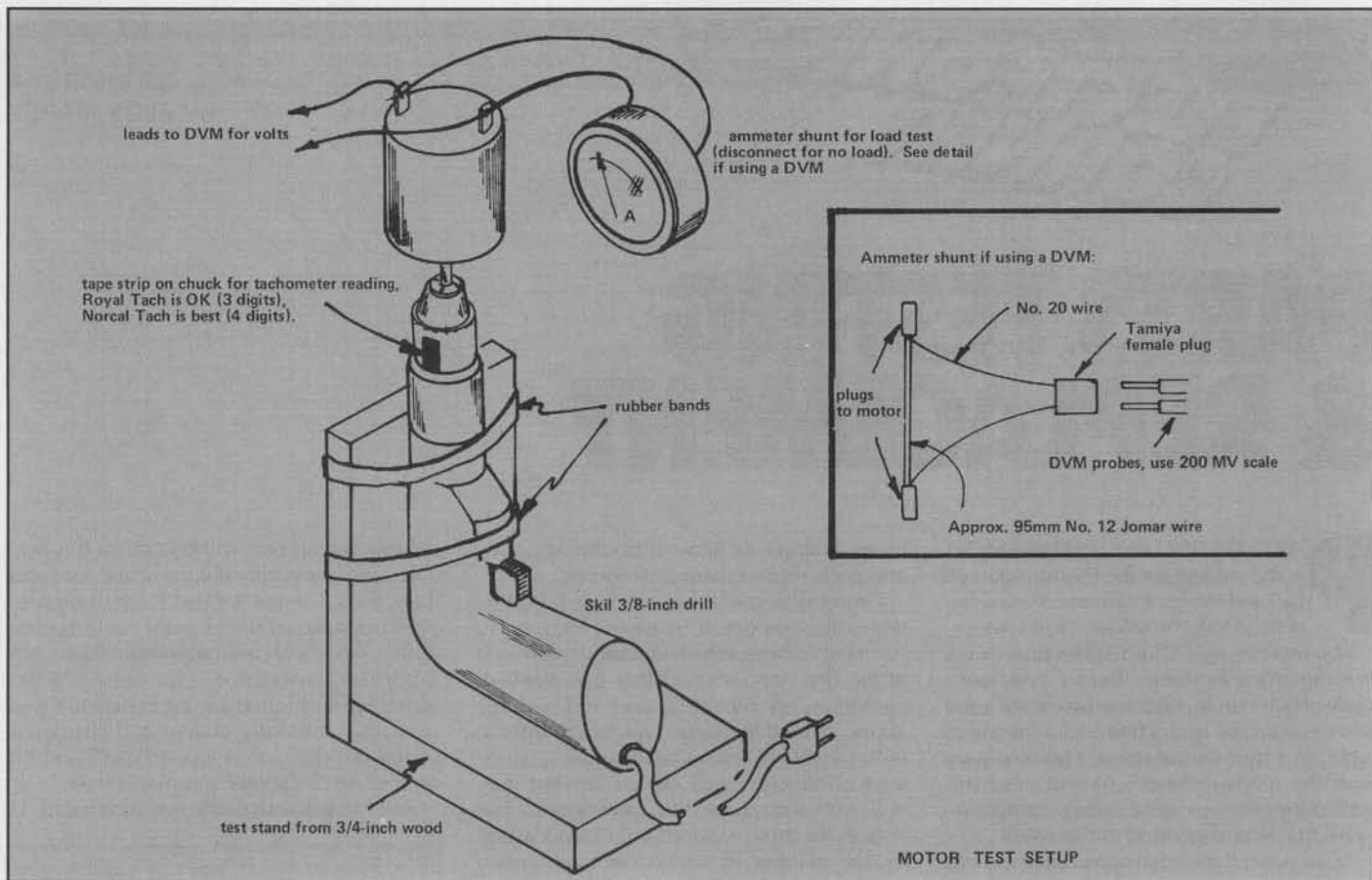


(Top) Mitch has some good things to say about the TRC Impulse 4 charger . . . see text. It's one of several items of interest to electric fliers being imported by Hobby Lobby. (Middle) For small models, Hobby Lobby is offering the Mini Olympics setup which consists of a Mabuchi 380 motor with a 2.3:1 gear drive. Retail for only \$22.00. (Bottom) The flagship of the line of Plettenberg motors imported by Hobby Lobby is the Hectoplett 355, a real powerhouse for 27-30 cells. Text describes performance. **Not inexpensive!**

tion, made the big powerful models possible. I think the electric 60 size planes will continue to grow in popularity. The equipment is now available to make these practical. The Astro DC/DC charger can charge the big packs, and the Jomar and Astro

throttles can easily handle the power.

Till next time, fly better, fly electric! My U.S.A. address is: Mitch Poling, 7100 CSW/MC, Box 734 PSC 2, APO NY 09220-5300. My Europe address is: Normannenweg 20, 6200 Wiesbaden-Biebrich, Germany. **MB**



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PARTS TESTING & REPLACEMENT

PARTS TESTING AND REPLACEMENT is the subject for the month, sparked by Ned Watts, Dedham, Massachusetts (AMA MCMXXI). Ned writes:

"Many years ago, I built a glow plug driver from an article in *Model Builder*. I enclose a copy of that article. After many years of good service from the unit, I finally did the inevitable. In a moment of stress, I hooked it up with the leads reversed, having never installed the diode (reverse voltage protection - em) that was suggested in the article.

"Can you tell me what parts I have blown? Assuming that they are transistors, the Radio Shack part numbers called out in the article are no longer available. Do you know what would be the appropriate substitutes?

"While I am fixing the driver, I would like to make it less sensitive. A little rotation of the pot will produce a large change in the amount of glow. Do I need to change R-10, and if so, to what value? Or is it just a matter of changing the values of R-3 and R-4. Again, if so, to approximately what values? Finally, I would like to put an ammeter in the circuit. I assume that this can go in the plus lead just before it goes to the plug. If I cannot find a good one-to-five amp meter, I would like to at least make the LED easier to read in broad daylight. I understand that there are now extra bright LEDs that may be suitable for this purpose. Do you have a part number or specification that I can use for this?"

Our appropriately named writer did not say exactly when he had built the glow driver in question, but the article appeared in January 1976, so if he built it at that time or soon after, it has been going for fifteen years or so, which is not bad for any electronic product, either commercially manufactured or home brewed. It also proves the solidity of the design, which was done by a Mr. Brian Ellis, who did a number of excellent electronic articles for MB around then.

Ultimately, it was zapped by reversed voltage, the Number One killer of electronic speed controls in the RC car hobby. Also the Number One reason for accompanying letters that start off with, "This is just the way it was when I opened the box . . ." Normally, Ned's letter is of the type that I answer outside the column, but I chose to do it here

as an example of general trouble shooting and parts replacement procedures.

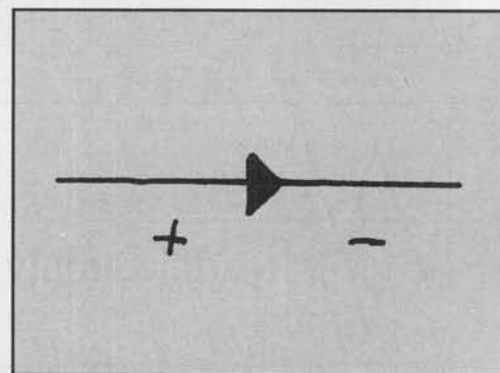
Generally speaking, semi-conductors (transistors, diodes, IC's) are not forgiving to reversed voltage, which will send them west at the first nano-second that it is applied. However, in repeated reversed voltage application to the same type of circuit, the failures will not always be the same . . . some semi-conductors will always fail but they will not always be the same ones. The reason for these random failures is caused by the manner in which each individual semi-conductor fails, which it can do as either a shorted or an open circuit. A shorted component will of course pass on current to the next one in line, possibly causing it to fail, while an open circuit will stop the flow of current, thereby protecting the ones that follow. In any event, the first step is to suspect ALL semi-conductors and test them.

Easier said than done, you say. Well, not really; at least not where it applies to diodes and transistors and don't forget that an LED is also a diode! IC's are something else, and unless you are equipped with an oscilloscope, have some familiarity with the circuit involved, and can check for an input and output, there is little to be done except a trial replacement.

The checking of diodes and transistors even while in the circuit, is a simple matter, which in spite of the sophisticated equipment available for their testing, requires only a common ohmmeter. Let's take the diode first, which as you will remember, is a sort of one-way gate, having a low resistance in one direction and a high one in the opposite direction. These high and low resistances are what we are going to look for and what will give us a clue as to the condition of the device in question. There are some precautions in the use of an ohmmeter for such a test: the voltage at the test prods should not exceed 3 VDC, and the current should not be higher than a few milliamperes. Too much in either case will damage the device being tested, however, if such instruments do exist, I have never run across one, and I have been testing semi-conductors in this manner since they became readily available. Certainly all mod-

ern test instruments will be safe for this test, and if we zap a ten cent transistor now and then, well, I guess we just have to be prepared to make sacrifices, huh? For tests such as this, when precise measurements are not a primary importance, I far prefer the (to some) old-fashioned analog meters to those nervous, constantly changing digits; we'll center our discussion around them and hit on the use of digital instruments later.

Refer now to our diode test sketch (No. 1)



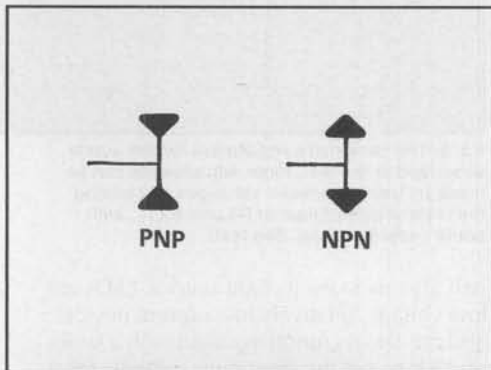
No. 1. With meter probe polarity needed to obtain its relative forward resistance.

and use a diode known to be in good health during your learning period. With our ohmmeter set to the 1K or 10K position, apply the test prods as shown, positive (red) to the anode, and negative (black) to the cathode. Adjust the meter range (1K or 10K) for approximately a midscale reading. This reading we will think of as "low." Notice that this and all further test readings are to be thought of as being relative only, exact values are not important. In fact, if you take an exact ohm reading as described with the meter set at one range, and then change it to another range, you will find widely different readings. The reasons why are not important to what we are attempting to do; it is important only to keep the meter set at the same range for the remainder of any testing.

Now, reverse the meter leads to the diode; positive to the cathode, and negative to the anode. You will be seeing a much higher effective resistance now, generally higher than the maximum for the scale in use.

Again, the exact value is not important, and there is no need to change the scale in order to obtain a readable value. The low/high reading, the actual front-to-back resistance of the unit, is a go-no-go indication that it is OK! This is a valid test for 99.99% of the time for an out-of-circuit diode, and for more often than not, one that is actually installed in a circuit. In the latter case, however, one can expect that some circuits will have paralleled components that will result in erroneous readings, and if the low/high reading described is not obtained, unsolder at least one lead of the diode so that a fully isolated test can be made.

Abnormal readings other than the low/high one described to be expected will include full shorts, two lows, or two highs, all of which indicate a defective diode.

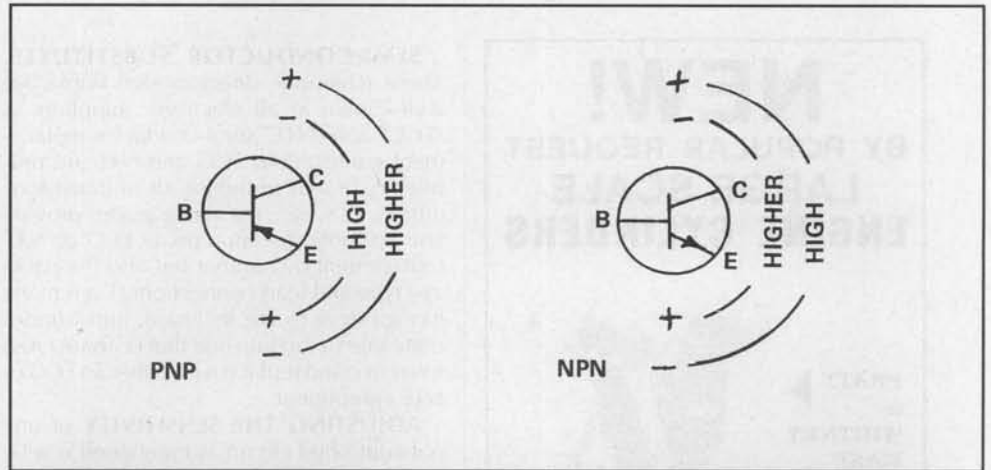
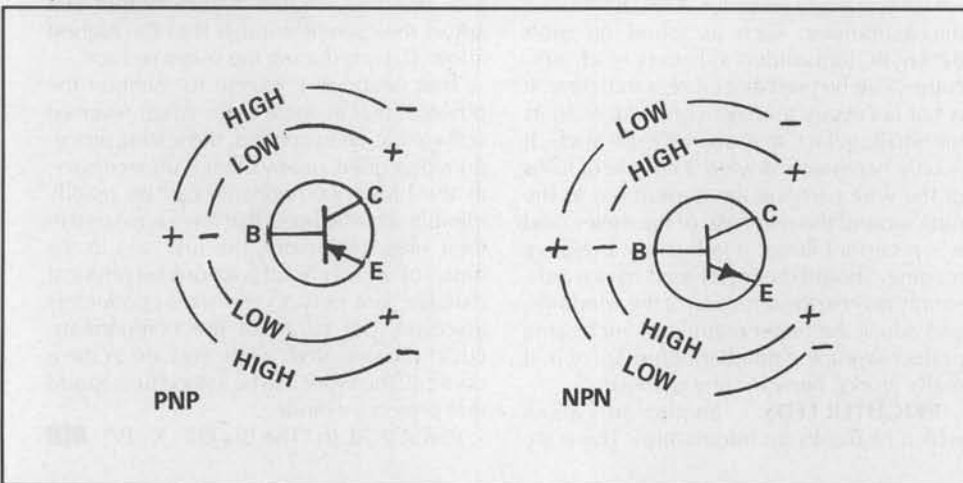


No. 2. Back-to-back diodes, connected to show the base-to-emitter and base-to-collector effects under the test conditions described.

Simple, isn't it? Transistors? Well, the procedure is basically the same, and like with the diodes, one time around will make you an expert! There are only two things that need to be remembered, that for this purpose, a transistor will act like two diodes back to back (Sketch No.2), and . . . this is important . . . that there are two types of these little miracle devices; PNP, and NPN.

These designations, P = Positive and N = Negative, refer to the internal makeup of the transistors, the relationship between its different elements. In practice, the choice of transistor type is determined by the polarity of the circuit involved; PNP transistors are

No. 3. Low-to-high relative resistances that can be measured between transistor elements with meter polarities indicated.



No. 4. Resistance relationships within the transistor collector to emitter. Any defective device will exhibit greatly differing readings.

connected with positive voltage at its emitter while NPN types have negative at that point. Reversing those polarities results in what started this discussion in the first place.

Please refer now to our transistor testing sketch No. 3. The first test is a low/high resistance check of the base to collector, and base to emitter, each one exactly as we tested a diode in the earlier example. We look first for the low resistance so that we can adjust the meter range, and remember that it is not changed for the high resistance test. You will notice that we are now looking for two sets of low/high readings, from the base to each of the other two elements. The low reading is always obtained when the ohmmeter lead corresponding to the middle letter of the transistor designation is applied to its base. That is, for a PNP transistor, start with the negative (N) meter lead at the base; for an NPN type, use the positive (P) lead.

Now, there is yet one more check to be made, a collector to emitter ohmmeter test. See our sketch No. 4 for that one, which is just another repeat of what we've done up to now, except that in this case we get meter readings with widely varying differences.

Everything is done exactly as described for the diode testing, such as expected deviations in readings, and the out- and in-circuit test results also apply to transistors.

Now for the all-important meter to use. Again, the procedure just described works

best with an analog dial-type of meter. The range switching described will only have to be done the first time, as there are some differences from one meter type and brand to another. But once you have determined at which range (1K or 10K) your particular meter gives the best test results, you can use that range for all future tests. My trusty Simpson 260 works at its 1K range, and has never lead me astray during testing.

Digital meters are another story, and there are so many that I won't even attempt to tell you which will work in this application. With one exception, most won't, especially the cheap ones. But if you have one, try it with components known to be good, same procedure, and see if the numbers will stabilize consistently enough to give you definite low/high readings. Your chances are better with the better grade of DVM, though many such instruments are now available with a special diode test position, which in some manner changes their internal workings in such a way that positive low/high readings are readily obtained. If you are in the market for a meter, and prefer or need the digital type, the diode test feature is definitely one to look for.

To point out how much easier and consistent this type of test is with an analog meter, I will point out that my test bench includes a Fluke 8840A Digital Multimeter, an instrument rated as accurate to 0.0028 percent on its 20K range, and which also meets the stated voltage and current ratings. It also costs about twice as much as your favorite PCM system, and it will reliably check semiconductors, but I still prefer and use the hundred-buck analog Simpson.

Obviously, you are going to have to identify by type, polarity (PNP, NPN), and lead arrangement. The best source of such information is the original schematic and parts placement diagrams, if such are available. If not, one will have to resort to any of the almost countless semiconductor manufacturer's manuals which describe such items, including lead arrangements. The ones I find most useful, which are available free from the electronic supply houses, also answer another important question Ned asks, that of:

continued

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SEMI-CONDUCTOR SUBSTITUTES. These telephone directory-size books are well-known at all electronic suppliers as "ECG" and "NTE" semi-conductor replacement guides. Both ECG and NTE are proprietary brands of thousands of transistors, diodes, IC's, etc.; the above guides provide you not only the appropriate ECG or NTE replacement by number but also the package type and lead connections. Even many foreign devices are included, and I find it quite rare to run into one that I cannot cross reference and replace with either an ECG or NTE component.

ADJUSTING THE SENSITIVITY of any pot controlled circuit as mentioned is relatively easy. Let's take Brian Ellis's glow plug driver circuit as an example . . . see sketch No. 5. Note that the total of the three resistors is 23.9K ohms, and we need to keep as close to that total value in the circuit as possible. The unacceptable sensitivity mentioned is caused by too rapid a resistance change in the pot R10; we can ease that by reducing its value. However, we first need to determine at which end of the pot the desired action is to be found. For example, if the proper adjustment point, even though critical to set, is around the pot's mid-position, we can simply replace it with a smaller value, say a 5K unit, and add 2.5K to both R3 and R4. However, should the desired point be located at the top, towards R4, we would still use a 5K pot as a replacement, but add the entire additional fixed 5K difference to R3.

The 5K pot used in the example above is, quite frankly, a guess. It would make setting the driver less critical, but without knowing just how hard it is to set and what results are desired, one can only guess. If the operating range of the 10K pot is normally quite small, possibly a replacement as low as 2K is the answer, again adding the difference between it and the original 10K to one or both R3 and R4.

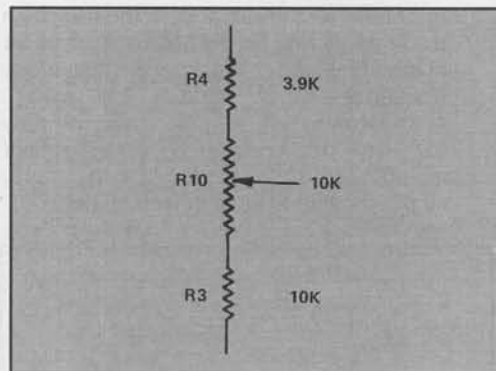
AN AMMETER for the glow plug driver is a necessity in my book, and Ned is correct on where to connect one. The best sources are the many dealers that advertise in the electronic magazines, some of which I have mentioned here before. Write for their catalogs and prepare yourself for surprising bargains.

There is an alternate to the 5 amp meter which you might consider. A small sensitive micro-ammeter, such as found on most decent RC transmitters as battery or RF indicators, can be used as a current indicator. It is not necessary to make connections to its terminals, in fact, they are not to be made. It is only necessary to wind a couple of turns of the wire carrying the current out to the plug around the rear case of the meter, and when current flows, it will show a relative reading. Should the meter read backwards, simply reverse the direction of the windings, and adjust the meter reading by increasing or decreasing the number of turns. Try it, it really works! Now for one of those:

BRIGHTER LEDs. . . another area about which Ned asks for information. There are

two easy ways to effect that: one being simply to sub-mount it inside whatever it's mounted in, preferably even enclosing and viewing it through a small opaque tube. This does limit the field of vision considerably, but is not a real hardship in cases where constant monitoring is not necessary.

Secondly, one can check the current through it, and if it is being operated at less than maximum, increase it until it is, which



No. 5. The sensitivity adjustment for the article described in the text. Finer adjustments can be made by using a smaller value pot and adding the resistance reduced to R4 and R3 . . . with some considerations. See text!

will also increase its light output. LEDs are low voltage, relatively low current devices, and are always found installed with a series resistor to set the operating current. Most LEDs are rated at about 25 milliamperes, which even most unknown brands will stand. If the one in question is running at less than that value, decrease the series resistor a little bit at a time. Without knowing any actual values, it is not possible to quote you any actual figures. It is all a cut-and-try situation, and by making small resistor changes, you can find the proper one with no LED damage.

The new high brightness LEDs are late developments, some of which are capable of higher current and thus higher light outputs, and others which are simply multiple devices in the same plastic package. Radio Shack catalogs a number of such LEDs, used as an example for their ready availability. One such is called a "Tombstone Red," no doubt for its rather distinctive shape, which is rated at 30 mA. The others are not rated in the catalog, but always are on the cards on which they are packaged. You need only to pick one that is rated at high output and adjust the current through it to the highest allowed, by reducing the series resistor.

That is about it, except to mention the obvious; that in some cases when reversed voltage has been applied, the testing procedure described, or any other is unnecessary, as the blown components can be readily identified by the holes that have appeared in their sides! Therefore, the first step in the repair of such a circuit is to look for physical damage, not only to the semi-conductors involved, but to all of the components. Luck! Oh yes, Ned, while you are in there doing all this work will be a good time to add that protective diode.

PERSONAL to "The Big Elf": X - IV! **MB**

COUNTER *Continued from page 15*

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Mark has created the same printed or computerized index for *Wings and Airpower* from 1971 to 1990, containing combined sequential and main topic listings. Arrangement has been made with Sentry Books for a discount offer on back issues of both magazines, which is included with each order. The disk is \$9.95 and the printed indexes are \$4.50, all postpaid.

For more information on all of the above, contact Mark Fineman/Aeroindex at P.O. Box 5124, Hamden, CT 06518.

• • •
We're happy to announce that at long last, the "Hey Kid" series, written by Bill Warner, and originally published in *Model Builder* magazine has been released by Tab Books, Blue Ridge Summit, Pennsylvania 17294-0850, a division of McGraw-Hill, Inc. This series, which ran for 14 months in *MB*, beginning in November 1987 and ending in December 1988, was the most definitive, down-to-earth, easy-to-read . . . and educational introduction to the very basics of model aircraft building and flying that we've had the privilege of reading (and better yet, publishing) throughout our (gulp!) sixty-year relationship with model airplanes.

Bill, now retired from elementary school teaching and living in northern California, is an award-winning model designer, builder,

and flier, and has written and had published many articles over the years, in *Model Builder*, *M.A.N.*, *American Aircraft Modeler*, *Scale Modeler*, and other publications. He also taught the "Aeroplanes and Flying Machines" class at the California Museum of Science and Industry for 17 years.

In addition to an infinitely well-written text, the book is illustrated by many of Bill's photos. But the real star of the illustration department is Jim Kamen, Bill's choice to create concise, crystal-clear, pen-and-ink cartoon drawings that clarify everything that Bill puts into words. They are classics!

All we can say is that we are proud to have brought this series to the beginning modeler public, and are relieved that Tab has compiled the series and made it available to the general public. We hope that everyone who has been bugging us about this series will contact Tab and place their orders. It is definitely time-capsule material!

• • •
If you've been around the model building hobby for better than 20 years or so, and particularly into the fine points of engine development and rebuilding, as well as into control line, the name George Aldrich needs no further explanation. If you do need an explanation . . . hey . . . we don't have space for all of it in one issue of the magazine! Anyway, after a 15-year hiatus, the unavoidable urge has taken over, and George, aka Aldrich Models, 12822 Tarrytown, San

Antonio, Texas 78233, phone (512) 656-2021 (not after 2200 [10 pm] C.S.T) is reactivated and once again offering R&D and kit development, specialized import/export supplies and custom engine rework and repair. New to the business will be old timer ignition engines, to be reworked and/or restored. In addition to full chrome and rechrome service is the special heat treating and fitting of cast iron piston/steel cylinder engines.

The myriad of details of the services that George is offering is too lengthy to include herein. We suggest you contact him by letter or phone, and let him fill you in on the details. You can also find more information, particularly where old timers are concerned, in John Pond's "Plug Sparks" column in this issue. Just be sure to tell George you read about this in *Model Builder!* **MB**

MODEL DESIGN *Cont. from page 10*

for the purpose. First and foremost, it is light. It is available in a range of densities. It is also relatively strong for its weight, easily worked, paintable, easily glued, readily available, non toxic, environmentally safe, relatively stable, long lived, and cheap.

You don't accept "cheap?" Considering the price of other materials these days, balsa is still reasonable. When I was a kid I paid *continued on page 51*

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Bob Boucher

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AUSTRALIAN O.T. NATIONALS

December and January are generally months of scarce information and photos for a columnist, so why stick around in the cold? The obvious answer is to go to Australia where summer is in January.

The event was the Australian Old Timer Nationals. This being my seventh trip to the "Land of Oz," this writer was hoping to see designs that are rarely built. No such luck, as the Aussies have the same problem as their American counterparts, the rush to win a trophy. In short, the "pot-hunters" dominate the scene.

Weatherwise, temperatures ran in the one hundreds . . . very similar to Sacramento Valley weather in July. The most disappointing aspect of the Aussie Nationals was the two days of rain on the closing days.

To show what the boys used to win, let's take a look at some pictures. Seen in one photo is a king-sized Strato Streak, powered by an Enya 60 four-cycle. Cranking on the model is the SAM 1788 secretary-treasurer, Dave Brown. Owner-flier Steve White holds onto the model.

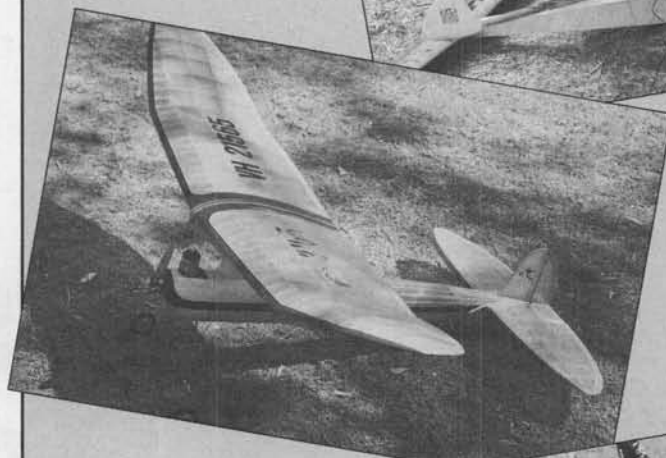
Another hot one that has been outstandingly successful is the 125% scaled-up Zipper as built by Lionel Jones. Powered by a McCoy 60, this model is a spectacular performer and seems to always qualify for the flyoffs.

Interestingly, Australia rules call for four five-minute flights out of five with bonus landing circle points. This qualifies you for the flyoff. As many as a dozen have flown off between four and six p.m. Although only one event a day is flown, this can make for a long and tiring day.

The foregoing is for the Duration Event. The Texaco event is quite similar with four ten-minute flights required for the flyoff. The times seem too short to this writer, as many of the Texaco models had motor runs of six to eight minutes. A ten-minute flight would be academic.

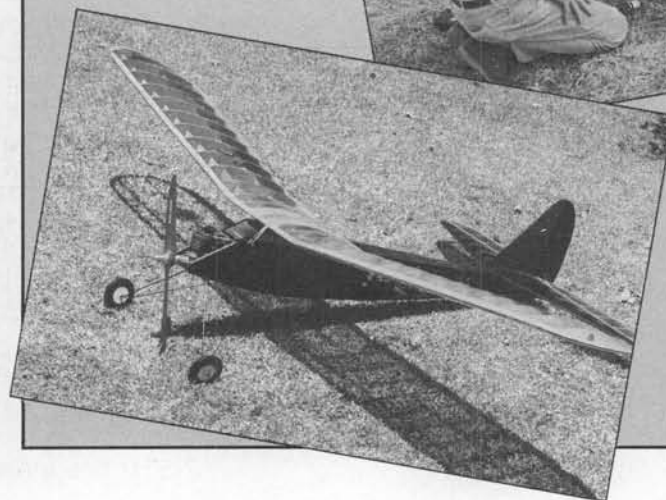
Pretty models abounded, such as Harold Stevenson's standard size Zipper with an Enya 46 four-cycle engine for power. Four-cycle engines are quite popular for the two events, Duration and Texaco. Stevenson should be noted as an early pioneer, producing ignition engines in the days after WWII, under the banner of H&S Engines (S for Stevenson). We will eventually feature one of his engines in our "Engine of the

A king-sized Strato-Streak for the Duration Event, by Steve White. Dave Brown cranks.



A good-looking and good-flying model by Lionel Jones, 125% scaled-up Zipper with very popular McCoy 60 power.

A well-built Zipper by Harold Stevenson, one of the original Old Timers in Australia.

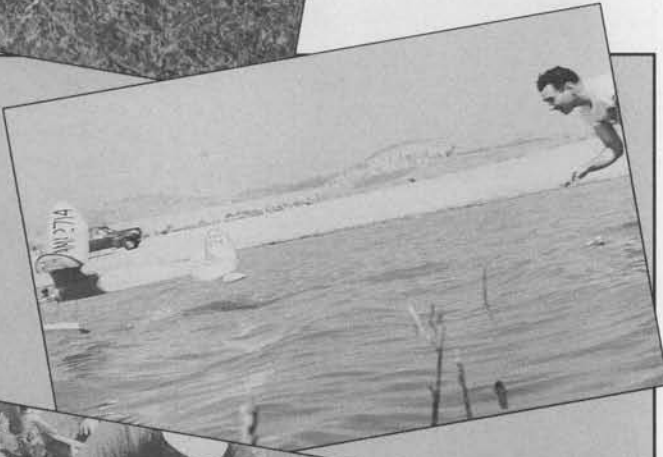


Albert Fisher's RC-1 with four-stroke O.S. 60, open rocker type, is a good flyer.



Italian builder Vito Santacesaria produced this 1942 German glider design known as the "Professor."

Fine R.O.W. takeoff by Bob Holland's Nostalgia design, "Hybrid," at Lake Elsinore, 1950.



Mal MacLean runs up his Owat diesel in his Czech "Meteor" design.



Dave Stott flew this Earl Stahl "Hurricane" very successfully at Westover AFB.



A "Flying Phantom Jr.," designed by Bill Atwood, built by Brad Allen.



Month" section.

Probably the most amazing thing about Old Timer activity in Australia is the apparent lack of interest in free flight. Although three events (power, rubber, glider) are held, entries for a Nationals are low, on the order of ten for each event. This has been a source of concern for free fliers, especially Dennis Parker, one of the foremost promoters of Old Timer F/F activity in Australia.

The spectacular success of the "Hangar Rat" indoor event is enough to make any modeler's head turn. Ever since Max Starick of South Australia started promoting this event and making up kits to interest the would-be indoor flier, entries have increased every year for the past four years.

This year, the H.R. event drew 72 indoor fliers. The main reason (in this writer's viewpoint) is that everyone builds the same design, utilizing the parts as outlined on the plans. Considering a low ceiling (about 40 feet), times are remarkably good for this simple R.O.G. design that appeared in *Model Builder*.

This event seems to be the answer to the complaints that no one flies indoor. Small wonder, what with the sophisticated equipment, building, and trimming skills required. This writer is aware that several attempts have been made to popularize such indoor events as Penny Plane, but in the last analysis, any design has been permitted, allowing the experts to come in and ruin an event designed for the younger set. What we need to attract modelers is something simple like the Hangar Rat event and the simple rules that go with it. The proof is in Australia!

One other notable increase in entries is the much maligned (by the F/F group) Old Timer C/L Stunt event. This writer was present at the processing lines and noted no less than 27 entries by noon. Jumping Jehosephat! What the boys here in the US wouldn't give for that interest! In all defense to the US C/L boys, the O.T. C/L meet at Phoenix seems to be the answer, as it does draw heavily . . . as long as they keep it Old Timer and do not try to improve the state of the art!

Two things were noted in Australia: the lack of ignition engines and the extensive use of four-cycle engines. The first item could be addressed by giving more flight points for those using ignition. The second, the use of four-cycle engines should be encouraged. This writer viewed several in flight; a real pleasure to watch fly with **reduced noise!**

WELCOME, CZECH SAM CHAPTER

Thought I might include this in the column although I must admit to having been badly scooped by *SAM Speaks* and numerous club newsletters.

The original article written by Don Bekins was an outline of his trip to Czechoslovakia and the people he met. As the Czech language is rather incomprehensible to most English speaking modelers, Bekins resorted to speaking German, a language most Czechs took in school.

Bekins was rather amazed at the quality of models (despite the lack of balsa wood) built

from spruce and plywood.

As in all Slavic nations, equipment is in rather short supply. Don had traveled to Czechoslovakia to encourage O.T. RC flying. The biggest problem is that the cost of living is very low with resultant low wages, and to acquire radio sets at their present prices is next to impossible.

To offset this, Bekins has embarked on a one-man crusade to obtain old 27 mhz sets. This is a legal frequency in Czechoslovakia. The plea is now going out for those old out-of-date sets that could be used abroad. If you have any of these antiquated sets, check with Don Bekins at 85 Bellevue Avenue, Belvedere, CA 94920; (415) 435-0977.

Inasmuch as a SAM Chapter has been organized in Czechoslovakia, it would behoove us American SAM members to take a look at the back shelves to see if we have one of these unusable (by American standards) RC sets in working condition. Don will be most happy to field all telephone calls, letters, etc., in his efforts to aid the Czech O.T. RC movement.

ENGINE OF THE MONTH

This month's subject is cousin to the very first engine ever illustrated in the "Plug Sparks" column of *Model Builder*. The Model B Brown shown at that time was the 1941 design.

The Brown B that first appeared in 1934 was the first commercially produced internal combustion model airplane engine. Up to this point, Bill Brown, in conjunction with Walter Hurlleman, produced about fifty Model A engines on a custom-built basis. This caused some confusion when Hurlleman produced the Model A engine under the name of Hurlleman. This was short-lived, as the newly formed Junior Motors Co. threatened legal action if production of the Hurlleman Brown engines continued.

Most every competitor, for that matter anyone interested in gasoline powered engines, ordered the Brown Jr. They, including this writer, were not disappointed, as the Brown Jr. engines started and ran well, one of the paramount reasons for the excellent sales enjoyed by Junior Motors.

Like all engines, the Brown Jr. had certain faults. The timer, which was simply a spring steel loop, would lose its elasticity after some running time. Rubber bands tied around the loop were strictly a field "quickie-fix," as the engine would still misfire. The best timer was the one manufactured by Walter Hurlleman.

Although Hurlleman suffered from lack of Brown Jr. engine production, he more than made up for the loss with his reliable timer designed to fit the Model B Brown. This writer can remember very vividly how the Hurlleman timer made the Brown an extremely reliable runner. All three of the writer's engines were fitted with the fine Hurlleman timer. As a matter of fact, Herb Wahl, of Wahl Motors, P.O. Box 61, Forksville, PA 18616, is still producing these timers. Those fellows with the old spring steel timer on their Browns would do well to change timers.



Sune Stark never seems to wear out! At 71, he won the 1990 Swedish Champs with his 1936 "Tip-Top IV" design.



Dick Korda seen in 1946 with his conversion of the F/F Cleveland "Champion" design to Control Line.



At a gathering of SAM 00 members, Howard Osequeda sets up his hydro version of a "Scram."

An Astro Cobalt 05 electric-powered 1938 "Pacific Ace" by Larry Oliver. Photo by Jim Alaback.



"Switchitis." That dreaded disease did in Frank Lashek's "Bombshell."

Another fault (if it can be classified as such) was the mounting lugs, which were entirely too thin to withstand any hard crash. Many a time, this columnist had new lugs welded onto his crankcase. This was eventually corrected in the later Model B engines in 1938 where the lugs were increased in thickness.

The drawing we are presenting was part of the Brown Jr. engine brochure in 1934. As can be noted, the engine design was patented. At this point, we must thank Jim Alaback, newsletter editor of SAM 41 (known as the San Diego Aeronauts), for drawing our attention to the series of Brown engines produced: A, B, C, D, Marine, and the small "E" model known as the Brown-E or "Brownie." Alaback had been publishing photos and write-ups on various engines under the column section, "Engine Spotters Guide." Very well done!

To repeat history, Bill Brown had his first successful engine in 1930. Teaming up with Maxwell Bassett, Bill's engine was in a gas-powered model that was entered in competition for the first time ever in a model airplane contest in 1932.

It competed against the rubber models, because until then, there was only rubber power for flying model airplanes! Although it placed fourth, most rubber model designers pooh-poohed the gas model as it did exhibit a very poor glide.

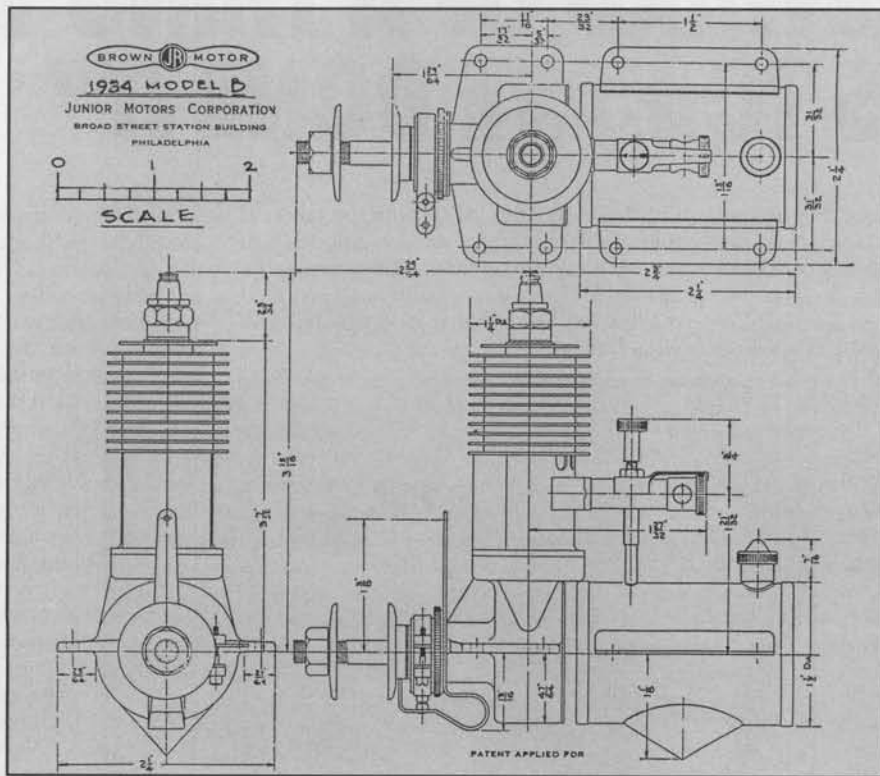
Little did they know what they were letting themselves in for. Maxwell Bassett subsequently cleaned house by winning the Mulvihill, Stout, and Moffet trophies. Bassett taught the "rubber" boys a real lesson; when needing more flight time to win, he simply put more gas in the tank! Vernon Boehle, an outstanding rubber flier of that period, was simply outclassed. Needless to say, the NAA allocated a special Texaco event for gas powered models at the 1934 Nationals (which Bassett promptly won again!).

The rush was on! Brown Jr. engines were in great demand. It was not until late 1935 that the Baby Cyclone was introduced, based on Bill Atwood's sensational win at the Sacramento State Fair. This was quickly followed by the Gwin Aero (Bunch), The GHQ (Loutrel), and the Ohlsson Gold Seal. Gas models soon outclassed all others for interest and entries.

What about Bill Brown? After he left Junior Motors, Bill devised his own engine, the

Lykens Brown, preferring this over the "Brownie." In his judgment, Bill felt the Brownie needed some work. Lack of performance caused lack of sales and the engine was withdrawn.

The Lykens Brown was quite successful but as usual, Bill found himself with more orders than he could handle, inasmuch as Megow Model Co. had taken on the distributorship and sales. This also faded away as WWII approached.



Several years ago, Bill started to produce the "Lykens Brown" (named after William Lykens Brown) with Herb Wahl handling the paperwork. Again, many things prevented Bill from completing this project, including the building of a new home.

Eventually, to get out from under the torrent of letters requesting the Lykens Brown, all manufacturing rights were turned over to Herb Wahl. According to Wahl, production is to start in 1992. These will feature the usual impeccable work for which Herb is famous.

Bill Brown, himself, has gone back to producing small CO₂ compressed air engines that he fathered with the Campus 100 engine in 1947. He produces engines on a more or less custom basis. These air engines are so small they can be used for indoor flying! Seems like only yesterday that Brown caused the gas engine revolution, but it has been almost 60 years!

MODEL OF THE MONTH

With this issue, we hope to begin a series of long overdue three-view type drawings of little-known Old Timers. Hopefully, this will eliminate that complaint of "I don't know what it looks like," and will encourage modelers to try different designs.

The first model we have selected is the

"Little Diamond" popularly attributed to John Drobshoff. What few modelers know is that John's younger brother, Alex, was the actual designer and builder of this pylon design.

Close comparison with John's "Challenger" reveals that the Little Diamond design is a development of the cabin model. Some changes in the wing and tail surfaces are to be noticed; larger wing span, higher aspect ratio and perhaps a little longer tail moment.

In placing the design credit to Alex, this is no reflection on John, as the two were inseparable on the field. Where Alex did most of the building and finish work, John's specialty was running of engines and the adjustment and flying of models. The combo was almost unbeatable. This writer recalls that John won six straight contests in 1940, with first prizes of at least \$50.00.

Naturally, with such success, the Drobshoff boys were invited to join Advanced Engineering of Fresno, California. Headed by John Baker, a considerable number of designs made their appearance, among which were the Drobshoff "Challenger" and "Vanguard" designs.

Alex Drobshoff died of stomach cancer in 1941. It was almost ten

years later that John fully recovered from the loss of his irreplaceable brother and started flying again. Ironically, about 45 years later, John died of the same malady.

Getting back to the model, the Little Diamond is what the name implies; a small pylon ship with a fully sheeted diamond fuselage designed to accommodate .19 to .23 engines. Putting a square framework on edge is a simple way to make a more streamlined model, especially when fairing stringers are added to the nose.

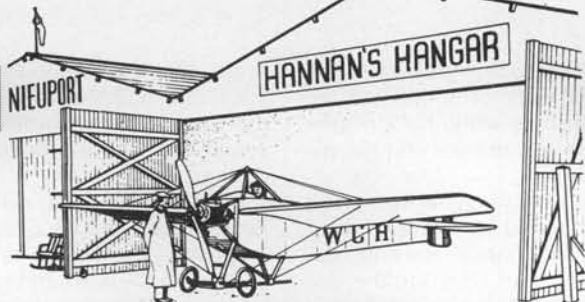
This design, recently uncovered and certified as an Old Timer, should be properly credited to Alex. Construction is quite similar to the Challenger, and should pose no problem. One point should be made, and that is that inasmuch as this design is considerably cleaner than the cabin Challenger, the Little Diamond does fly faster. Care should be taken with adjustments in the opening flights. Such care will result in a model of winning performance.

READERS WRITE

Australia

Received a photo from Albert Fisher of Australia, of an RC-1, a radio control model as originally designed by Chester Lanzo.

With modern power such as the O.S. 60
continued on page 77



BY BILL HANNAN

"THE REWARD OF A THING WELL DONE IS TO HAVE DONE IT"

Our lead-in line, from the pen of Ralph Waldo Emerson, certainly applies to most aspects of model building . . .

BOB PECK

We regret to report the passing of Bob Peck, co-founder of Peck-Polymers, at the young age of 57 years. Bob's enthusiasm for models covered the entire spectrum, including boats, trains and aircraft from tiny Peanuts to huge RC blimps. Although confined to a wheelchair, Bob transcended physical limitations, traveled extensively and participated actively in model exhibitions and contests, as well as serving as a consultant to the San Diego Aerospace Museum.

He and his wife Sandy organized Peck-Polymers as a part-time operation at first, to manufacture fishing lures. Moving into model aircraft, they evolved a line of Peanut Scale and sport models plus accessories which became a full-time business with international distribution and recognition. Additionally they produced custom-made RC specialty blimps for various organizations in the United States as well as in foreign countries.

Bob is survived by two daughters, Vera and Jill, a brother, Jerry Peck, and Sandy, who intends to continue operation of Peck-Polymers.

Bob Peck's spirit will live on in his work and in the hearts of all of us who were fortunate enough to have known him personally. The message seems clear: We are as fragile as the models we fly . . . and must appreciate each other, NOW.

IS MODEL BUILDING ART?

This question was raised by Peter H. Spectre in *WoodenBoat* magazine, and shared with us by Don Typond:

"Is modelmaking art? Most people would

say it is not. After all, no interpretation is required in building an accurate model. You merely copy the original, right down to the last deck cleat, at a smaller scale. Model-makers tell you what it is; artists tell you what it means.

work of one modelmaker and another? Even among the most accurate models . . . those thought to be as close to perfection as humanly possible . . . why are some cold, some hot, some warm, some heartless, some stunning, some drab, some filled with the jauntiness of the sea?"

BUILD BETTER!

Sportsman's Aviation Booster, edited by A. Lee Spencer, featured Ed Purdy's rules for better building of home-built aircraft. We felt some of the advice could be equally useful to modelers:

"**Never** believe dimensions given in the plans. They may be accurate, but is your piece accurate? **ALWAYS** check the fit of your part, then use your measurements.

"**Never** work on your project when you are tired, hungry, angry, depressed or about to do your income taxes.

"**Never** believe you have discovered a 'better way' to make a part or use a substitute that will work just as well. There are **No Shortcuts!**

"**Never** answer the question 'When do you think it will be ready to fly?' In fact, **Never** answer any question that begins with the word 'when.' Your answers will **Never** be right."

Ed admits to having broken most of the rules himself, and reserves the right to add new ones as he gains more experience!

VARIETY IN MODEL BUILDING

Peter Van Dore, of Elkins Park, Pennsylvania, says: "From May to August, I fly big, noisy, dirty and expensive; September to March, small, quiet, clean and cheap."

NAGOYA PEANUTEER

VISITS HANGAR

Jiro Sugimoto, one of the leading Japanese Peanut Scale model builders, recently arrived in California and successfully nego-



(Top) Howard Voss examines a selection of Jiro Sugimoto's Peanut Scale models. These and many others will compete in the 1991 Proxy Peanut contest in Japan. (Above) Pete Redhead (center) on the SAM stand during the 1990 Model Engineer show in England. Note great variety of models, including Earl Stahl designs. Photo by Christine Redhead.

"But if modelmaking is not art, why is it that, in the upper reaches of modeldom, where the best do their work, there is an identifiable difference in 'feel' between the

tiated more than 1,300 miles on the "wrong" side of the road compared to his homeland. It was a real pleasure sharing ideas with this modest master craftsman, and learning more about the forthcoming Proxy Peanut contest he is helping to conduct.

The Nagoya club hosts this meet every other year, and the 1991 event is scheduled for August 13, 14 and 15. Entries should, however, be in Japan by July 31 to allow time for model repairs if needed, and help determine the number of proxy-fliers required.

Categories will include Pioneer, WW1, Golden Age, WW2, and Postwar Peanut, plus a one-design event for BD-4s. A novel provision for the BD class is that entrants may employ their choice of color and markings, the reasoning being that this aircraft is a home-built, and anyone building a full-size version would certainly choose a personal color scheme. Sounds to be a real opportunity for self-expression.

Peanuts are very popular in Japan and these contests are wonderfully orchestrated with top-notch proxy fliers, experienced judges and marvelous facilities provided by the Toyota automobile company. The actual model flying is conducted outdoors in the Shonai Green Park, prizes are unique, and complete results are provided to every entrant. Why not try your luck/skill?

Complete entry information and rules may be obtained by sending three Post Office International Reply Coupons to: Mr. Shoichi Uchida, 3-24 Asanaka, Ogaki-shi, Gifu-Ken, 503 JAPAN.

HOW'S THAT AGAIN?

Says Warren Shipp:
"If at first you don't succeed, don't."

"LOST SQUADRON" UPDATE

From an article by Ed Davis for *In Flight*, we learned that the crew trying to recover the six P-38s and two B-17s trapped beneath 260 feet of Greenland ice have examined one B-17 via an exploratory cavern, and were disappointed to find severe damage. Although it now appears that the hoped-for perfectly preserved aircraft may not be found, many parts and artifacts have been recovered, and more may be sought.



NEW GLUE?

Considering the large variety of adhesives available to modelers, one might assume that no other possibilities are open to us. Not so, says Jim Poche, of River Rouge, Louisiana, who has constructed his most recent models with "Weldbond." Jim assures us he has no connection with the company, however, he is most enthusiastic about the product because it is non-toxic, odorless, and dries clear and flexible. Further, it is solvent-free, fuel-proof and water resistant, and is useful as a sealer as well as an adhesive. Sounds to be worth trying!

FAC VIDEOS

We have reviewed two videotapes relating to the Flying Aces Club contests recently, compiled by Dean McGinnes, who bills himself as "Executive Producer, Director, Editor and Janitor," assisted by Shawn Theiss and Bob Rendel. The Flying Aces club itself is quite a phenomenon, having been started by Dave Stott and Bob Thompson during the 1960s. Nostalgia for the good-old-days *Flying Aces* magazine, coupled with a fondness for the fun and simplicity of rubber-powered flying scale models, prompted them to create a series of low-pressure events to encourage others to join in the action.

Lo these many years later, the concept has spread to the extent that the FAC Nats attracts more flying scale models than any other contest in the world . . . period. There must be a message here! And it can be easily appreciated by viewing either of the FAC videotapes. Although there is overlap in coverage (some of the footage appears in both tapes) the thrust of each differs: Video number one, nearly two hours in length, features static-scale judging, personalities, and lots of model flying, including the remarkable mass-launched events (complete with mid-air collisions), and is titled *FAC NATS Mk VII*.

The second tape, called *Han-*

(Top) The late Bob Peck prepares to start CO₂ engine Baby Ace during a contest, as his wife, Sandy, looks on. Photo by Bill Warner. (Middle) Typical of the spectacular flying scale models featured in the Flying Aces Club videos is this AVRO triplane by Vance Gilbert. Photo by Tom Schmitt. (Bottom) Alejandro Alvarez of Uruguay, South America, displays his fine-flying Peanut Volksplane, which can exceed a minute and a half in flight.

gar *Flying with the Flying Aces*, also has many model flying sequences, however, it includes interviews with the club founders and other notables, their philosophies and techniques. Viewing either of the tapes will make it obvious what a special group of individuals are keeping this facet of the hobby alive, and you just may want to join them in order to share their fun and satisfaction.

Each tape is \$22.95 postpaid in the USA. Foreign readers should enquire about video compatibility and extra postage requirements: Swamp Squadron, FAC, 1503 Clairdale Lane, Lakeland, FL 33801. **SAVE YOUR TOYS!**

We don't mean model airplanes, but actual toys, which are gaining in value at an astonishing rate. Ed Whitten sent news of a recent auction in which tin and cast-iron toys were expected to attract bids from \$600 to \$1200 each! The entire collection of 362 toy cars, aircraft and banks was expected to sell for from 300 to 500 thousand dollars.

Ed also sent a survey of the 20 best-selling toys currently on the market in New York, and noticed that not a single airplane, boat, train or automobile appeared!

ON THE SUBJECT OF TOYS

Model Builder contributor Skip Ruff assures us that having a five-year-old son gives him the perfect excuse to buy all the toys he (Skip) wants . . .

PLANE OLD MODELS

Among the most unusual kits we have seen are *Plane Old Models*, produced by Mark Schmidt. They are not intended as exact scale models, nor to fly. Rather, they are representation models, intended to display the "character" of various vintage air-

craft in the simplest, most direct way. Made from materials described as "plain old household wood stuff" plus odds and ends such as card stock, the finished models are surprisingly effective, and a selection of them is on view in the Arizona Pima Air Museum.

The variety of offerings, mostly pioneer types, is extensive, numbering 85 in all, and

engineer by 1952 and a corporate vice-president in 1956. Among rewards for his efforts were two Collier and Albert Reed awards, the Wright Brothers Memorial Trophy, the Guggenheim Medal, the National Air and Space Museum Trophy, and three Presidential Citations.

Our thanks to Ed Whitten for this information.

GENE THOMAS

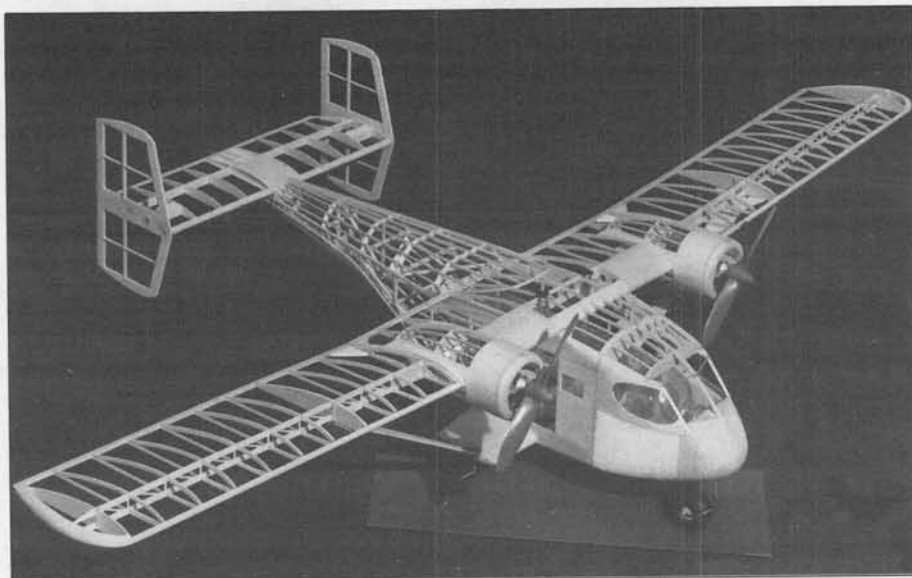
Long-time artist, modeler, pilot and former *Model Airplane News* magazine "Research Room" column writer, Gene Thomas, died during late 1990, according to the Greater New York Antique Airplane Club newsletter, sent in by Warren Shipp. Gene's interests included plastic model kit package design, production of flying scale model kits and restoration of full-size antique aircraft.

NEW CLOUGH MODEL

Many of our readers will recognize the name Roy L. Clough as the designer of a long series of fascinating models for various model magazines. Roy has recently returned to the hobby, brimming with fresh ideas, and is now offering a power package for small flying models. Included are a "Mosquito" electric motor, propeller, NiCd cells, wire and construction plans for his 16-inch span "Superskeeter" free flight sport model. Not furnished are the polystyrene foam and balsa materials needed to construct the model. Of special interest are Roy's instructions, which are unusually complete and clearly written, giving many of the "whys" as well as the "hows" of operating this system.

The complete package sells for \$25 postpaid, or the electric motor and batteries may be purchased separately at \$17, as may the

continued on page 80



Beautiful Antonov 14 framework by Doug McHard of England. This free flight model features two Italian compressed-air motors with a running duration of about 1-1/2 minutes.

extending from Leonardo da Vinci's Ornithopter of 1490 through the Vickers Gun Bus of 1913. In between are such designs as the Sir George Cayley helicopter of 1842, Alphonse Penaud's 1871 Planophore, Lawrence Hargrave's 1890 flapper, Clement Ader's 1890 Eole, Gustave Whitehead's #21, and Henri Fabre's 1910 Hydravion.

Each kit costs \$9.95 postpaid, from: Plane Old, Box 934, Green Valley, AZ 85622.

KELLY JOHNSON

Clarence "Kelly" Johnson, designer of numerous famed Lockheed aircraft, passed away during December of 1990 at age 80. Among the better-known types with which he was associated were the P-38, Constellation, P-80, F-104, U-2 and SR-71.

Joining Lockheed during 1933, he became chief research engineer by 1938, chief

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"ARF PLANE OF THE YEAR"
-Model Builder Magazine, 1989



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KYOSHO CONCEPT 30 SX

BY JAMES WANG

This month we will take a close look at the newest version of the Concept 30, the Concept SX. As nearly 20,000 Concepts have been sold, and more than half of them are in beginners' hands, we will also use this opportunity to show beginners the fundamentals of setting up a new RC model helicopter. I will try to keep the jargon used in this month's review simple, so readers who may be interested in getting started in RC helicopters will understand.

For the past few years, 30-size helicopters have become more and more popular. They are compact, inexpensive, newly engineered, and fly quite well. There are presently five 30-size model helicopters on the market; Concept, Enforcer, Shuttle, X-Cell 30, and TSK 30. The first three models are made from injection molded plastic and are very resilient. The X-Cell 30 is made mostly from aluminum, and has the proven X-cell 60's molded main rotor head. Finally, the TSK 30 is almost completely made of metal and has superb workmanship, and a lofty price tag

of \$1000, while the other four all hover (*Oh, really!-wcn*) at \$400 or less. Each one of these models has its strength. In *Model Builder* we have reviewed the Shuttle, Enforcer, and Concept.

In January 1991 *Model Builder* we reviewed the Hirobo Shuttle ZX. Out of the three 30-size plastic helicopters, Shuttle ZX is the most 60-like model helicopter. It tracks very well in fast forward flight and there is almost no nosing-up tendency. Forward flight behavior is extremely smooth, and controls are solid and crisp. It is

great for doing "smooth" aerobatics at small flying fields. The Enya 35H that comes with the kit performs surprisingly well. It took us six hours to take the ARF Shuttle ZX from the box to flying. From the first flight there were no vibrations at all. Therefore, if the reader is interested in a ZX, we strongly recommend the ARF version of the Shuttle ZX that comes with the Enya 35H already installed.

Last month we took a detailed look at the 30-size Kalt Enforcer helicopter. The Enforcer was designed by Mr. Shigetada Taya,

The Concept 30 SX is the top of the line model in the Concept 30 series. It features ball bearings for all the mixing arms, thrust bearing in main rotor blade grips, double ball bearings in the clutch, metal mixing base for the Bell-Hiller mixer, and metal balls on swashplate. Notice the extra header tank to increase fuel capacity.



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the same gentleman who designed the Concept 30 DX, SE, and SX. The conclusion was that it is a very nimble 30-size helicopter, slightly more agile than the Concept SE and SX because of the hingeless rotor head which is slightly stiffer in the flapwise direction as compared to the articulated offset hinge design used on the Concept. Both models have about 90% Bell-Hiller mixing ratio, which makes them stable. Enforcer is ideal for radical hot dogging. The replacement parts are inexpensive, too. For beginners, we recommended fitting a set of Concept DX's aluminum paddles to make the Enforcer even easier to fly.

Of the three 30-size models that we reviewed, Concept is the most docile model. It almost sits there in hover by itself. After a flight with the Concept 30, one does not feel stressed out. Secondly, of all the model helicopters on the market, regardless of engine size, Concept is a model that can consistently take abuse and keep on going. Especially, with the stock foam blades, we have crashed the Concept on many occasions and were able to get back in the air in less than five minutes. When there is a boom strike, foam blades will not dent the tail boom as much as wood blades.

There was an article in another model publication that branded the Concept as unsuitable for beginners because in hard landings the main rotor blades tend to come down far enough to strike the tail boom. Well, because of the soft flapping restraint design, Concept does have an occasional boom strike problem, but, its super user-friendly flying characteristics far outweigh the boom strike problem. Furthermore, it is this soft flapping design that makes the model so easy to fly. In fact, it is probably the easiest model helicopter to fly in the world. Therefore, I have no holdback in recommending Concept to any beginner.

The DX was reviewed in the June 1989 issue of *Model Builder*. The SE and many of the tune-up accessories were reviewed in the June 1990 *Model Builder*. The DX is specifically



Author's friend David Franklin's Concept SX with Kyosho Jet Ranger fuselage. Added weight and drag of scale fuselage has almost no effect on the Concept's performance.

designed for the beginner. It retails for \$369.95. It comes with a set of heavy aluminum Hiller paddles which make the model super stable in hover. I rate the DX as the easiest RC model helicopter for learning to fly. It does not have ball bearings in the control mixing arms. As most beginners will probably bang their first model a few times while learning, one possibility is to purchase the less expensive DX model and learn on it. Once you are able to comfortably hover and fly around (usually about three months), then up-

grade the DX to an SE by purchasing the upgrade package (about \$60), or then buy a larger, 60-size machine. The 30-size machine can then be kept as a fun machine for burning holes in the sky, and use the 60-size to add finesse to your flying skill.

Concept 30's are gas-powered model helicopters. There is an EP Concept, which is a small electric helicopter. Many RC car modelers are thinking of learning to fly RC helicopters indoor on an electric heli. Well, the electric helicopters do fly well, but they require more experience in setting up, otherwise the performance will be marginal. Furthermore, in order to keep the weight down, electric helicopter parts are thin and fragile. Therefore, unless you want to exercise great care while learning to fly, the gas Concept is definitely the way to start. But, the electric helicopters are great fun, especially for RC car

enthusiasts who already know how to hop up electric motors, and know all the inside tricks to battery charging. Then, they can really extract a lot of performance out of these cute models. We will look at the Kalt "Whisper" and EP Concept in coming issues.

The Concept SE is one grade higher than the DX. The SE retails

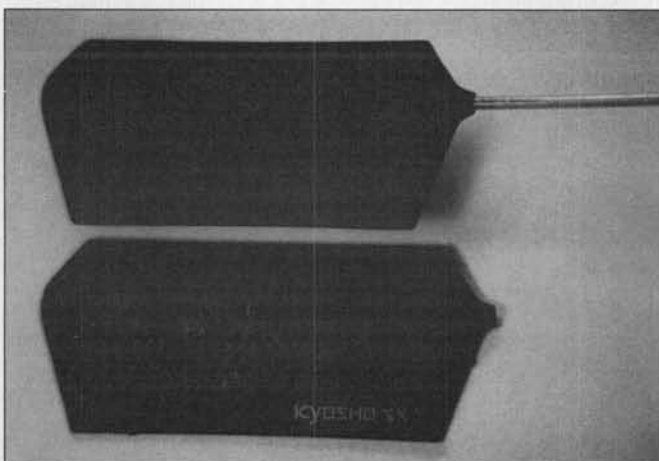
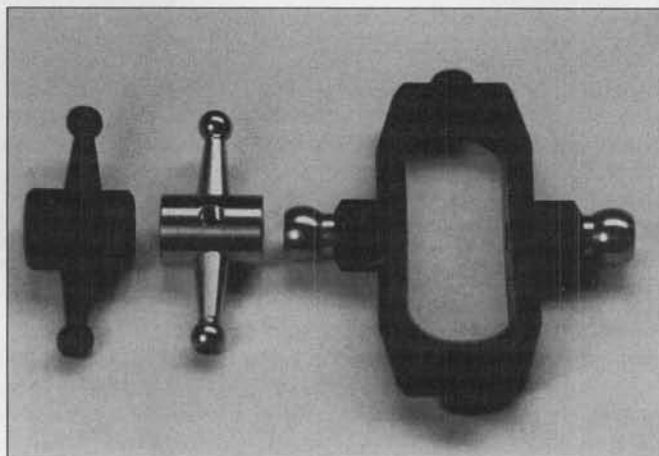
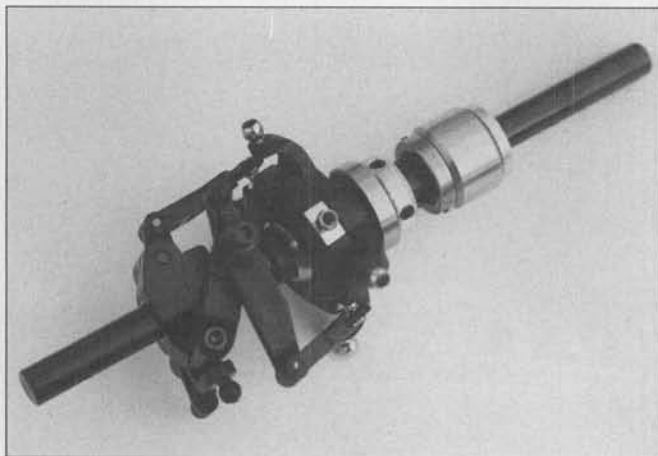


The author enjoys a relaxing flight in sunny Southern California. When properly set up, the Concept is probably the most relaxing model helicopter available. The text explains how to set up the Concept for beginners.

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for \$439.95. It has ball bearings at all the mixing arms. It also has a set of lighter plastic Hiller paddles to make the model much more aerobatic than the DX. The sacrifice is slightly less inherent static stability. In airplane analogy: the DX is like a high wing trainer, the SE is like a low wing trainer. The best part is that the SE comes with a ball bearinged collective slider collar which is smoother and allows more collective pitch (blade angle of attack) change than the DX. This allows the SE to do autorotations and inverted flight. But there still isn't sufficient collective pitch travel for lots of negative pitch for fast inverted climb out. If you are really careful, you can extract 17 degrees of collective travel range from the SE. If you set the top end at +10 degrees, then you can get -7 degrees for inverted flight. The collective collar on the DX does not allow enough negative blade pitch to do these maneuvers. DX only allows about 12 degrees of collective range.

The new SX is basically identical to the SE, but with most of the upgrade accessories that advanced pilots have requested in the past two years to be standard in the kit. For example, the main rotor blade grip now has thrust bearings to allow heavier main rotor blades to be used safely. Stock foam blades weigh about 70 grams each. This barely gives sufficient rotational inertia for doing autorotations. Many modelers use wood blades with lead added at the tip which increases the blade weight to 85 to 90 grams for easier autorotations. Kyosho has just introduced a 90 gram weight kevlar fiberglass blade. Thrust bearings make it safer to use heavy blades. This does not imply it is unsafe to use 85 or 90-gram blades on SE. I have been flying Alex Gauss' 30-size fiberglass blades that weigh 95 grams on the SE without any problem. (Alex's blades are \$69, and he can be reached at 804-485-4210.) Great Planes says the thrust bearings also improve blade tracking. The SX molded plastic blade grip has the pitch control arm moved inward by 5mm.



(Top) The sliding collective control collar, swashplate, and Bell-Hiller mixing unit come already assembled on the shaft from the factory. Notice the balls on swashplate. Only SX has these metalballs. The Bell-Hiller mixing arms are mounted on a metal mixing base. Only SX has the metal mixing base. Both SE and SX have bearings in the mixing arms. (Middle) SX has metal control arm for paddle control. SE and DX come with the black plastic control arm. Also shown is the seesaw unit on the SX. It has metal pivoting balls. SE and DX have plastic balls. (Bottom) The Hiller control paddles on the SX are 1/4-inch longer than the SE paddles. The picture compares the SX and SE paddles.

Therefore, for a given amount of collective collar movement, SX's blade pitch will change more than the SE or DX. This is great for hot dogging pilots who fly choppers rightside up and inverted. In June 1990 *Model Builder*, we showed how owners of DX and SE can drill a new hole 3mm away from the existing hole on the Bell-Hiller mixing arm to increase collective pitch control. I have been flying my SE inverted since I made the "drilled hole" modification.

The best feature on the SX is that all the swashplate ball-link balls are steel instead of molded plastic. The picture shows the SX swashplate and Bell-Hiller mixing arm assembly on the main rotor shaft. Unfortunately, the balls on the mixing arms are still molded plastic. Kyosho does sell a mixing unit that's completely machined from aluminum, but it costs \$90 (KYOE5110). There is also an optional metal swashplate for \$70, and a super-lightweight titanium main rotor shaft (KYOE5100) for \$28. Unless you are really serious about having your Concept as the most tricked out model, there is no need for these three items.

As shown in the picture, SX control paddles are about a 1/4-inch longer than SE's. This increases the fore/aft and left/right cyclic control response. This is great for doing tight loops and fast rolls, but the drawback is that in fast forward flight, the larger paddles make the model pitch sensitive. This means touching the elevator stick causes the model to balloon upward. I prefer the smaller SE paddles, and set up the cyclic servos to get maximum swashplate tilt for quick control.

A very nice addition in SX is the ball bearings for the clutch and drive gear assembly. These two ball bearings make the clutch engagement smoother and make the clutch system last longer. I highly recommend DX and SE owners spending \$24.95 (KYOE5044) and add these two ball bearings in their clutch. Maybe instead of buying the two bearings, it may be a better investment to purchase the machined metal drive gear from Century

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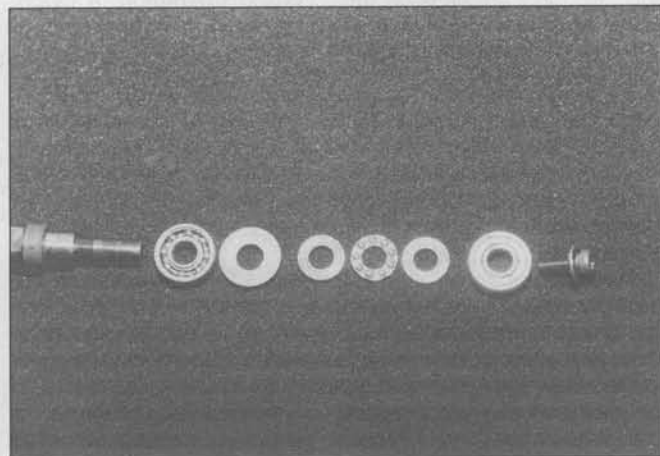
Import. It's available by mail from Helicopter World, or at hobby shops. The metal drive gear is nice because it dissipates heat and the teeth on the drive gear are beautifully cut. And the lining material is better than the steel liner on older Concept kits. The best part is that for \$37.95 the metal drive gear comes with two ball bearings.

We will not cover the engineering details of the Concept because that has been done in our DX and SE reviews. Instead, let's discuss how to set up the Concept. The instruction manual is very clear, it can be followed readily. If you have purchased either the DX, SE or SX as your first helicopter, here is how to set it up. The following guideline can be applied to any collective pitch helicopter in general.

Connect the swashplate pushrods to the second hole from the center on your elevator and aileron servo arms. This should give a medium control response rate. If you have dual-rate on your helicopter radio, set the low rate to about 85% deflection of the full rate. Actually, there is no need to use low rate on the Concept. I suggest you learn to hover and do forward flight entirely on high rate on the Concept. Do not use exponential or VTR (VTR exists on Futaba radios) for Concept because the controls are very docile already.

When setting up the radio, make sure that when the control sticks and trim tabs are in the center, the servo arms are square with the servo casing. When elevator stick (right control stick) is pushed forward, the swashplate should tilt forward. When aileron stick (right control stick) is pushed to the right, the swashplate should tilt to the right. When the stick is in the center, the swashplate should be perfectly level. Now, look at the helicopter from the side. The black control paddles should be parallel to the swashplate. Turn the paddles until both paddles are parallel to the swashplate. Rotate the rotor disk. The paddles should still remain perfectly level and parallel to the swashplate.

Next, set the left control stick and trim tabs at the center. The tail rotor servo arm should be in the center of the servo. Adjust the position of the tail rotor control ball link until the tail rotor blade pitch is about 15 degrees. Now, move the left transmitter stick all the way to the left. The tail rotor blade pitch should be about zero degrees. Depending on which hole on the servo arm the pushrod is connected to (try the second hole), at full left rudder stick the tail blades may have as much as minus five degrees. Now move the left stick all the way to the right, the tail rotor blade pitch should increase to about 30 degrees. If the blade pitch angle changes in the wrong



(Top) When not flying the Concept, slide a wire retainer on the skids to prevent the plastic landing gear strut from spreading due to the weight of the helicopter squashing down on the struts. Fabricate the strap from a coat hanger wire. (Above) Taking apart the SX main rotor blade grip, you will find, from left to right: blade feathering spindle, radial bearing, washer, thrust bearing assembly, radial bearing, and the 3mm bolt. Only SX has thrust bearing. DX and SE have two radial bearings. The feathering spindle is very soft and usually bends in a crash. If not replaced or straightened in a vise, the model will vibrate. Always check the spindle after a crash.

direction, then use the rudder reverse switch in your transmitter to reverse the tail rotor servo direction.

To set up the throttle control, first, make sure the servo is in the center when the left stick is in the center. Now move the left transmitter stick and throttle trim all the way up (forward). Attach the throttle pushrod to the third hole on the plastic servo arm on the throttle servo, but do not connect the other end to the carburetor arm on the engine, yet. Just hold the loose end of the throttle pushrod next to the outer hole on the carburetor arm. Adjust the length of the throttle pushrod so the engine carburetor is fully opened. Now, pull the throttle stick and the throttle trim all the way back. Do not adjust the length of the throttle pushrod. Hold the loose end of the pushrod next to the outer hole on the throttle arm. Check to see if the carburetor is fully closed. If it is not fully closed, then you need to use a longer servo arm, or move the opposite end of the pushrod to the fourth hole. If the pushrod moves too far and beyond the travel range of the throttle arm, then use the second hole on the servo arm.

It is very crucial that there is no binding for the throttle control. When the throttle stick is all the way forward, the carburetor must be exactly full open. When the stick and trim are both pulled back, the carburetor must be completely closed, and this will stop the engine immediately.

To start the model engine, the throttle stick should be pulled all the way back, but the throttle trim moved all the way forward (up). This should give the engine a nice idle speed, and the clutch would not engage. When starting the engine, always make a habit of grabbing the main rotor head with the left hand, and holding the electric starter in the right hand. This is a standard safety procedure, so just in case the hi-idle switch may be accidentally turned on, or there is any radio interference, or whatever reason, the main rotor blade would not suddenly turn in front of you.

We highly recommend using a helicopter radio system for any collective pitch RC helicopter because it makes setting up model helicopters much easier. With a heli radio you can maximize the model's performance by fine tuning the electronic mixing between throttle and collective pitch curve. Remember, five servos are needed for collective pitch helicopters like the Concept. Most inexpensive helicopter radios start at around \$250. The JR MAX 5 is a good inexpensive heli radio. It comes with five servos and a 1000

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CHOPPER CHATTER

BY JAMES WANG

In this month's "Helicopter World" we have a review on the Concept 30 SX. Instead of explaining how to set up new helicopters for beginners in the "Chopper Chatter" column, I've decided to explain it as part of the Concept review. This way, the Concept can be used as a specific example to help clarify the standard set up procedure. Next month, we will bring you the interview with top FAI flyer, Wayne Mann.

This month, I will also tell you what's new from my trip to the International Modeler Show in Pasadena, California. During my

World Champion in pylon racing proves it. Depending on the engine, a set of 60-size piston and sleeve is about \$90 from Dave. His pistons are machined from bar stock. Dave volunteered to install the piston and sleeve for me. Thank you Dave.

After I got the engine back, my friend Gary Frank and I measured the exhaust timing to be about 157 degrees. I remember Dave said it should be around 155 degrees. Anyway, the stock O.S. 61 engines are around 145 degrees. Raising the exhaust timing will usually give more power if a tuned pipe is used. Dave says the exhaust timing can



Dave Davidson, scale heli master, flying his BK-117 model. The color scheme is beautiful. Has X-Cell mechanics and Enya 60. It features a blinking light system. The model weighs 12 pounds. Full-size BK-117 is made by MBB in Germany.



Dave Davidson's magnificent Agusta A-109 at the 1990 Raves Funfly in Virginia. Notice the windshield wipers and pitot tube near the front window screen. Has scale-like retractable landing gear. It is a Heim kit with Webra 61 engine. The full-size A-109 is made in Italy and has one of the lowest drag coefficient of any helicopter.

trip, I had a chance to swing north to San Francisco, to visit one of the largest RC helicopter-only stores in the United States: Helicopter World/Century Import. It's the first time I have been to this store, and boy do they have parts!

First on the agenda, I have just installed an O.S. 61SFH Long Stroke engine in my Schluter Champion. This was an old engine that had been losing power. I called Dave Shadel at Performance Specialities, who sells custom ABC piston and sleeve units for O.S. and other engines. Dave is a famous engine man. His performance as

even be raised up to the 160 to 170 degree range. Some boat engines even have close to 190 degrees. Why don't stock engines come with higher timing? Higher timing means the motor has to be run with a tuned pipe, otherwise, there will actually be a loss in power. Higher timing may make needle valve adjustment more critical. With increased power output, there is more stress on the engine, and higher fuel consumption. Therefore, stock engines are, in general, fairly easy to run and set up, and provide good power on a muffler. There are stock engines that come with high exhaust timing; for instance

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the Rossi 60 is at 162 degrees. But these engines are called "pipe timed" engines, and they are intended for use only with pipes. My Rossi 61 came with a pipe.

If a stock engine is not pipe timed, a tuned pipe will only increase the power by a few percent. However, if the same engine's exhaust timing is modified to 160 degrees, then the same tuned pipe will boost the power significantly. Furthermore, higher nitro fuel seems to benefit higher timing engines with pipes more than lower timing engines.

The particular piston and sleeve set I got from Dave Shadel was what he has off the shelf. He says he can further modify the porting hole shape, or increase the timing to higher than 155 degrees to get even more power. I asked for his off-the-shelf unit so we could see how well the basic unit performs.

Well, my O.S. 61SFH with the Performance Specialties piston and sleeve ran very smoothly. Gary and I used a machinist dial indicator and trued the Schluter fan/clutch shaft assembly to within .001 inch. The Schluter Champion hover was extremely smooth. There was no foaming inside the fuel tank. In fact, the engine started on the first crank. The needle valve on the 6H carb was set at 1-1/4 turns. The transition between mid-range and full power was excellent. However, the top end power was not as strong as I expected. But this was only the first flight, and the engine was not broken in.

After three flights on Red Max 15% nitro fuel, we switched to 30% Magna fuel that was provided by Mike Donnel. This fuel is excel-

12.5% also has less oil and the oil is thicker. Magna 30 has very high oil content, around 23% and Tim says the oil is thinner. Why? He said by trial and error the thin oil seems to work better with high nitro. We definitely noticed that the flight time was shorter with the 30% fuel. More power means the higher nitro fuel is also burned at a faster rate, and as oil doesn't burn, all that amount of oil went to keep the engine cool. Therefore, Magna 30 fuel trails more smoke than other fuel in hover. It has a nice sweet smell, too.

An Enya No. 4 glow plug was used for our engine test. In general, I use Enya No. 3, which will give excellent idle. Enya 4 is a colder plug, which may not make the engine idle as low, but may last longer because the platinum filament is thicker. I highly recommend you try these two plugs. They are not inexpensive, about four to five bucks a piece, but they last longer and run better than less costly plugs. The Fox RC Long with idle bar was also tried and gave excellent results. The Fox Long can be used with almost any brand and size engine and gives excellent results. Surprisingly, the Fox plug worked great on the Rossi. It is very inexpensive, but doesn't last as long as the Enya. It is ideal for sport flying. The O.S. No. 8 is another very good plug, especially good on O.S. engines.

One reason that I am not getting as much top end power as I expected from the Shadel modified O.S. 61SFH is that I am using a standard Schluter 924 long muffler. Even a slightly raised timing engine can lose power, rather than increase power, when a muffler is used. Therefore, I should next install a tuned pipe to extract



The scale looking four bladed hingeless main rotor head on the BK-117. Made by Wiks in Germany. The little bob weights dangling on the main blades are called "bifilar pendulum." They are used on full-size BK-117 to reduce 4-per-rev rotor vibration. If enough readers are interested, I will explain the principle of how they reduce vibration in a future article.

lent, but expensive; about \$70 for a case of four gallons, and that's without shipping. It is brewed by Morgan Fuel Company for Miniature Aircraft. Its ingredients are specified by Cliff Hiatt, and modeled after the 30% MG fuel used by the winning Japanese team at the 1989 World Championships. Immediately, the engine picked up an extra 5 to 10% horsepower. Now, the Champion climbed more reasonably.

For sport flying, the Magna 30% may be costly, but Tim Schoonard of MAs says they offer a 12.5% nitro fuel at lower price. The



Another five bladed rigid main rotor head design. This one is made by Charlie Johnson in Virginia. His company name is on the canopy. Charlie sells this head for about \$400. Call (703) 448-0876. I have flown this head. It is very responsive. Wood blades are used. It would fly better and less responsive if soft fiberglass blades were used. Rigid hub multi-blade rotors are easier to make than the articulated flapping head. But articulated heads fly better.

maximum performance. However, on Sunday, my friend Gary Frank decided to try the Patriot missile technique and his new X-Cell 40 homed in on my Champion. All I remember was two rotor disks meshed together and a big bang, then the two models fell free 100 feet to the ground. This was my first helicopter midair, and was definitely more spectacular than my RC airplane midair a few years back. Afterward, Gary volunteered to take my new engine apart, clean the dirt out, and dial the shaft straight again. I will show you the aftermath picture in the next issue. Meanwhile, if you would like

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to try a Dave Shadel ABC piston and sleeve unit, you can find his number in the Performance Specialties ad. Last time I spoke to him, he was preparing to move from San Diego to Reno. You may have to check the directory for the latest phone number.

Let's talk about the IMS show. As usual, Futaba, JR (Hobby Dynamics), and Airtronics were there. The Futaba 1024 will not change for this year. The 5, 6, 7 and 9-channel radios are the same as last year. The JR 5, 6, and PCM-10 are also the same as last year.

RC helicopter pilots that I have known do not fly both airplanes and helicopters. Therefore, the versatile JR-347 may be more than what these local heli-only fliers need. But to my knowledge, the JR-347 has the two-servo Heim style CCPM feature for helicopters. (This means using two servos moving differentially to control the swashplate lateral tilt. When the same two servos move in unison, they control collective pitch.) This would make the JR-347 the most inexpensive radio in the US with CCPM. If you have a Heim or Vario helicopter,



A scale Vertol tandem-rotor helicopter without the scale fiberglass fuselage. Quite stable in hover. The kit is manufactured by Hirobo in Japan. It is available from Hirobo's U.S. importer, Altech Marketing. Costs around \$1500. It is powered by a single O.S. 32H engine.



Author's friend Jim O'Brien doing the nose-in hover practice with his GMP Legend Elite. Notice the intense concentration on Jim's face. After you have learned how to hover and do forward flight, the next most important maneuver should be nose-in hover.



This is heaven for RC helicopter modelers. Twenty-six models on display. Thousands of parts hanging on the wall.

The JR-347 has been out for almost a year. It is a modern programmable 7-channel radio that can store programs for up to four models. This radio has programmable features for airplanes, gliders, and helicopters. Hobby Dynamics says the 347 has been selling very well. There are probably over a hundred helicopter fliers in my neighborhood, however, I have not yet seen any heli flier with a 347. Maybe they all went to the airplane guys. Come to think of it, most



The 30-size Airwolf fuselage from Helicopter World Inc., \$129.95. Optional retracts, \$39.95. The fuselage is made from plastic similar to the Concept canopy, and it is pre-painted in black. The body will fit on Concept, Shuttle, Enforcer, and X-Cell 30. A

then it may be worthwhile to get the JR-347. X-Cell helicopters can easily be changed to work with Heim style two-servo CCPM. This would eliminate the mechanical tilting mechanism for the roll servo. If I remember correctly, the JR-347 cannot do 3 or 4 servo CCPM. Is that correct, Kevin Burner?

Futaba will be introducing the Super 7 in April. It will be similar in capability to the JR 347. It has programming features for RC

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airplanes, gliders, and helicopters. But, Steve Helms says it will be different from the JR-347 because the Super 7 "helicopter" will have switches located to suit heli pilots as first priority. But, it can also be programmed for airplanes. The Super 7 "airplane" will have the same features as Super 7 helicopter, but with the switches located to suit airplane pilots as priority. There is also CCPM on the Super 7. Sounds nice. We will have a review of this when it comes out in April. Futaba has just introduced the world's smallest electronic

gyro. The gyro mechanics and electronics are in one unit and together only weigh 26 grams; that's about one ounce. This is ideal for electric helicopters. This gyro should be out in April. Due to the popularity of electric helicopters, Futaba will also have a complete five-channel heli radio with super mini servos and electronic speed control for electric helis.

Airtronics will also have a Vanguard system with three tiny servos
continued on page 86



Tim Schoonard manning the Miniature Aircraft USA booth at the International Modeler Show in Pasadena, California. The text tells about the numerous new products that MA is introducing in the spring.



Helicopter World/Century Import's owner, Peter Chao, showing off his brand new Bell Huey Tow Cobra fiberglass fuselage for 60-size helicopter mechanics. Basic fuselage, \$289.95. Full kit, \$369.95, includes a welded metal landing gear, gun pods, and flexible tail drive cable.



The two-bladed main rotor head on the Vario mechanics in the Peka MD-500 body. What a colorful rotorhead with pretty ball links! Superb German kit engineering by Uli Streich of Germany.



The new Infinity programmable helicopter radio from Airtronics. The shape, electronics and software are designed in the USA. Has LCD screen display. You can program the radio by touching the LCD screen. You can elect to operate on any one of the 50 available frequencies by touching the screen. Isn't this wonderful? This one transmitter will work with any Airtronics or JR FM receiver on any 72-band frequency.



Our columnist visited RC Helicopter World for the first time on his recent trip to Northern California. The columnist says that he has never seen so many different brands of helicopter parts under one roof.

FINISH THOSE BUILDING PROJECTS

This must be the month that most of us find the weather is looking promising for outdoor activities of the free flight variety. If you live in the sunny south, you may not know what the rest of us, who live in areas with definite seasons, go through. We plan and build during the winter months, when we are not flying indoor models, and then await the coming of spring, so we can go outdoors and try those new superships. It's an exciting time. The local contests begin again, and we reacquaint ourselves with our contest-going friends from other areas.

If you are like me, you did some of the construction and repair that you had intended to do, but much remains undone. It's time to get into the shop and finish up those projects. My own building projects this winter included starting and finishing a Nostalgia "Zero" by Toshi Matsuda and building my first ever PayLoad model. Oh yes, I also did some more on the oft-postponed Flying Quaker Antique. Two undone projects remain for now: an F1J ship similar to the 1/2A Vee model featured as a three-view about 18 months ago in this column, and a new Nostalgia Ignition model, the "Plan-

eteer" by Maurice Schoenbrun.

So, once again, it is spring, and it is time to go out and fly; the ships not finished for now may have to wait through the contest season. If you are like me, you are ready.

MAY THREE VIEW . . . JOHN CARTER'S "SALAD CREAM"

This is a giant outdoor rubber model. In fact it is so big that it is ineligible to fly in any current AMA category except for the Dawn Unlimited event. It is a lightweight in the British tradition and with 490 square inches of wing area, it should glide for a long time. I would venture that it takes a big man to wind the five-ounce rubber motor to full winds, and it would take a firm but soft grip to hold onto the ship in preparation for launch.

John Carter, the designer, uses the ship only for flyoff flights in the British Open Rubber event. I trust that these flights are made when the winds are low.

If you are interested in competing in the Dawn Unlimited event flown at Lost Hills/Taft during the U.S. Free Flight Championships, you might find this model suits your desires to a Tee. If so, give it a try.

MAY MYSTERY MODEL

For this month's feature, I have once again gone back to those thrilling days of yesteryear and to a book that I have used a number of times to find unusual designs. This ship was created by a prolific designer during the postwar period, and it qualifies for the Nostalgia Ignition event. The original was powered by a Bantam .19. Another clue is that it used a single-wheel front landing gear and anhedralled stab to assist with the R.O.G. required in those days. It is a ship that came from the so-called "Pencil Bomber" school of thought.

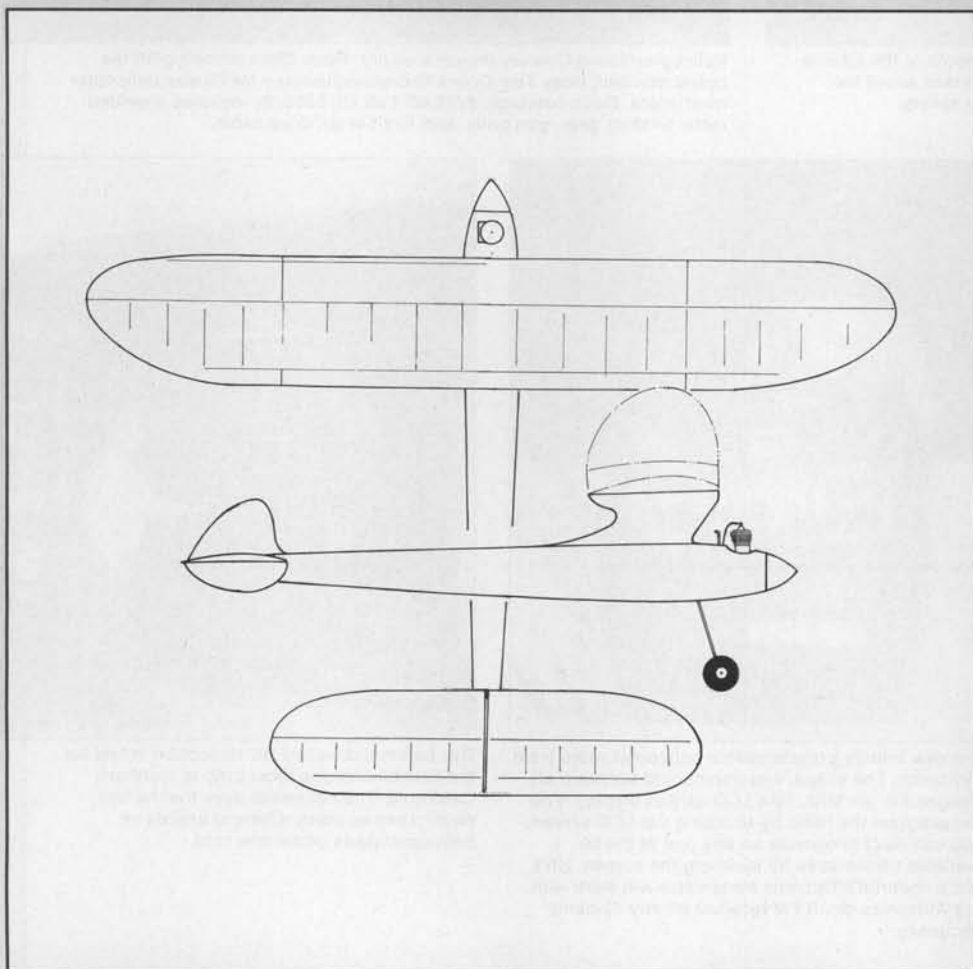
So, enough of this kind of information. If you know the name of the design, drop a note to Bill Northrop, c/o *Model Builder* magazine. If you have the correct answer and get it there before anyone else, you have won yourself a free subscription to the magazine. Hard to beat that offer, isn't it bunkies?

MAY DARNED GOOD

AIRFOIL . . . XGD 3

Peter King, from Great Britain, has been a solid Wakefield competitor on the interna-

MAY MYSTERY MODEL

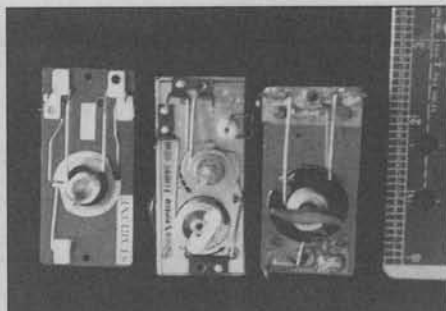


tional scene for many years. This airfoil is featured on his PK #6 Wakefield as detailed recently in *Vol Libre*, the French free flight magazine/newsletter. Peter uses a small stabilizer and VIT with his ship, and the wing is sheeted, using a D-box, for the front 1/3 of the airfoil. Both wing panels plug into the pylon. The ship is a fine performer.

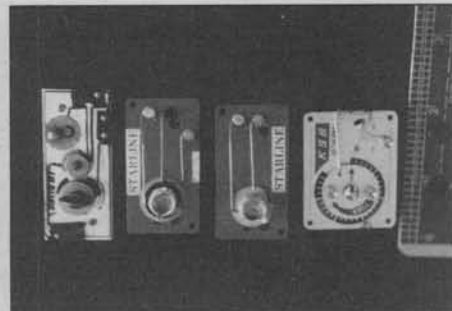
It appears that this airfoil would be a good selection for anyone looking for an out-of-the-rut section for Wakefield. It has the appearance of an airfoil that is shaded more toward the good glide category than the high climb category. Give it a try.

TIMER TESTS

Included in this article are the results of a series of timer tests that I ran on the new Starline timers. Look over this test carefully, and consider whether this selection of timers meets your needs. I found them to be exceedingly well made and smooth operating. I offered Sal Fruciano, the proprietor of



These are the timers used in the test. At left is the new Starline five-function F1C; center is the now familiar Selig four-function AMA or F1C timer; and right is an old-style Monks F1C timer.



Other timer types: At left is the Seelig Mini-Combo used primarily in Wakefield and small gas models. Left center is the new Starline three-function Wakefield timer. The right center timer is a two-function Starline. The right timer is the common K&B Dethermalizer timer.

generally available in Central Europe. They owe their origins to the Russian self-timer mechanism in the Zenit 35mm cameras. Zenit is the big Russian camera manufac-

"A by-product, then, is the Zenit timer mechanism, first adapted by Russian modelers. The 'Signature' timers that I sell are 'Androkov' replicas. My Polish manufacturer, Tadeusz Szpak, has provided me with quantities of the exact replica at prices that are reasonable.

"Timer mechanisms are heavier as they arrive from the USSR. In every case, the frame is milled. The clock spring is from a music box readily available in Europe."

Regarding the newly developed pinch-off timer, Sal offered the following:

"The demand for a pinch-off timer was foreseen about two years ago. Somehow, I reckoned the Japanese timers would finally disappear. The demand for hi-tech and high-dollar products could not allow small stuff to exist. This is exactly what has occurred.

"We tried to do a pinch-off that would solve some problems with the old designs. A major problem has always been the ability of the lever mechanism to push aside the oily, greasy surgical tubing on occasion. Therefore, we insisted the tubing be held firmly on both sides, providing a more positive pinch.

"As noted earlier, the timers are made in Poland by Tadeusz Szpak and friends. All are model builders/craftsmen dedicated to quality products designed and manufactured with intent to establish the leading edge of current technology in mechanical timers."

As you can see in the test data feature, the

TIMER COMPARISON TEST DATA

TIMER AND TYPE	WT.	*SIZE	PRICE	**TESTS	COMMENT
Tatone Old Style 1/2A	12.5	1.5x.75x.45	NA	#	
Tatone Old Style Flood	16.0	1.8x1.1x.45	NA	#	
Tatone Old Style Pinch	17.0	1.5x1.1x.45	NA	#	
Tatone Old Style D.T.	21.0	1.6x1.1x.45	NA	#	
KSB Fuel Cutoff	17.0	1.7x1.2x.40	15.50@	#	
KSB D.T.	20.0	1.8x1.3x.45	15.50@	#	
Seelig Minicombo	21.0	2.1x.95x.50	28.50	#	
Seelig 4 Function	39.5	2.6x1.5x.60	35.00	#	
Seelig D.T.	19.0	2.1x.95x.50	21.50	#	
Monks Old Style Multi	42.0	2.5x1.2x.60	NA	#	ab
Starline Pinch-Off	15.5	1.8x.9x.35	20.00	20.8/1%	cd
Starline 3 funct. 1/2A	17.0	2.35x1.0x.55	35.00	38.9/1%	cef
Starline 3 funct. F1B	15.0	1.9x1.0x.50	30.00	45.9/6%	bf
Starline 2 funct. F1B	15.0	1.9x1.0x.55	25.00	46.4/1%	b
Starline 5 funct. F1C	23.5	2.6x1.2x.55	35.00	22.3/1%	bh

Code:

* First number is faceplate length, second is faceplate width, third is depth from back of faceplate to back of chassis.

** Timer test consists of two factors. First number is the maximum time available for the shortest running disk or arm. Second number (in %) is the amount of variation timed when several runs are timed and compared.

Time tests not conducted.

NA Timer no longer available from retail sources.

@ Timer may not be available from retail sources. Price is that

most recently quoted.

a Timer needs arms/levers constructed before it can be used.

b Not equipped with an on/off switch.

c Prototype timer, not yet in production.

d Has camera timer works, similar to KSB or Kurt. No back cover.

e Pinch-off fitting included.

f Two adjustable discs plus D.T. scroll.

g One adjustable disc plus D.T. scroll.

h Three adjustable discs plus D.T. scroll.

Note: Construction features of the Starline timers, except for the pinch-off prototype, are virtually identical in each variation. The timer frame is brass and the faceplate is made from aluminum, as are the discs and scroll. The works behind the faceplate are exposed except for the enclosed mainspring. The arms are fastened to the faceplate with aluminum fittings that lift the hinge area above the faceplate in order to minimize line hangups. The entire works is soldered to minimize vibration damage to the timer. All timers have a soft windup action that is conducted by turning the scroll via two small "ears" that extend beyond the end of the scroll. The scroll and the discs are adjustable by loosening the scroll and turning the discs as needed. All discs are directly attached to the drive shaft by the scroll. Quality of the timers is excellent with precision evident throughout.

Starline, my time and energy to run these tests, and he generously offered me the use of these timers for that purpose.

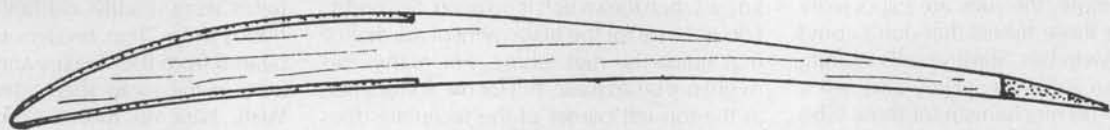
To set the scene, Sal writes: "Polish timers have been around for more than 15 years,

turner, turning out high quality cameras for the world market. The big problem is that they are 20 years behind Japanese technology. They still use electro-mechanical rather than electronics in their cameras.

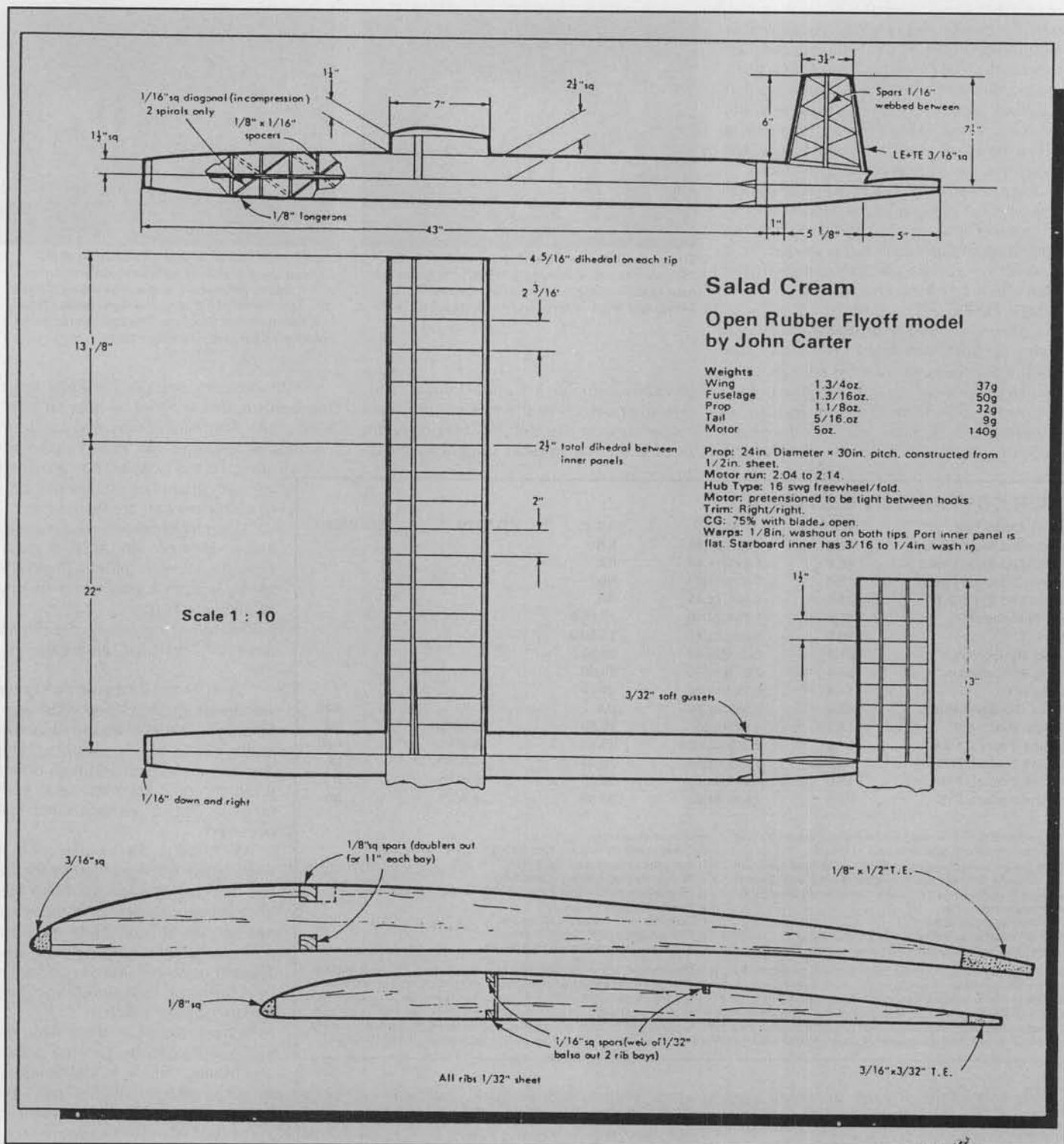
craftsmen dedicated to quality products designed and manufactured with intent to establish the leading edge of current technology in mechanical timers."

As you can see in the test data feature, the

DARNED GOOD AIRFOIL — XGD 3



STA	0.00	1.25	2.50	5.00	7.50	10.0	15.0	20.0	25.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.	
UPR	0.65	2.20	3.20	4.50	5.60	6.50	7.70	8.5	9.0	9.20	9.10	8.50	7.50	6.26	4.75	2.90	0.05	
LWR	0.65	0.00	0.10	0.30	0.50	0.70	1.20	1.60	2.10	2.55	3.20	3.70	3.75	3.15	2.27	1.20	0.00	



timers were measured, weighed, and run to determine consistency. As these are production timers and use the same works from sample to sample, the runs are expectedly identical. For those timers that don't come with built-in switches, Starline sells locking switches as an accessory. They also sell a remote pinch-off mechanism for those who need such equipment. Order all timers and accessories from Starline International, 6146 E. Cactus Wren Rd., Scottsdale, AZ 85253.

The prototype pinch-off timer is available as you read this article. However, I have made two recommendations to Sal to im-

prove it. One is that the switch is in need of some redesign, as it is very similar to the KSB type lever, and consequently it is difficult to know when the switch is on or off. Secondly, I do not care for the placement of the device that holds the fuel tubing. For many, this might not be an issue, but for me, its location at the top-left corner of the faceplate does not provide the same flexibility as if it were placed at the bottom-left corner. Sal noted that he would look into incorporating these changes in the next order.

ASTRO FLIGHT 1/2A STARTERS

You remember those nifty little 1/2A

engine starters that Astro Flight used to sell? Until about five years ago, these units that were in regular use at most of the free flight fields were readily available at your local hobby shop. Then, mysteriously, they disappeared from the shelves and became a hot item in the swap sheets and swap meets. Well, wait no more. According to Ross Thompson, they are available again. Contact Miller RC Products at P.O. Box 425, Kenwood, CA 94952, or call (707) 833-5905. Miller RC has them for \$34.00, and they also sell rubber inserts for the old Astro Flights as well. I understand that the new



How long has it been since you've seen a Goldberg Viking 1/2A free flight? Well, Steve Burchett constructed this one and flew it at the Willamette Modelers Club Fall Annual FF meet. T.D. 049 power.



Dave Vincent silhouetted against the sky in preparation for launching his RamRod 750 Nostalgia model.



John Crosseto just released this Cox Reed Valve powered DaBox, a nostalgia legal FF ship. Scene is the WMC Fall Annual FF Meet.

units are black, instead of the white finish of the older versions. Ross reports that they seem to be smoother operating than the old ones. At any rate, you should get yours while they are still on the market. Who knows how long they will last?

REMOVING GLUE

Aha! The nemesis of the household. Remember the days when you used to chew that stuff off your fingers and thumb, and when your mom used to carry on at length about the glue you got stuck on the counter-top? No more! Now, according to Jack Tatum, Editor of SAM 74 in Clear Lake, California, you can use magic in the form of "Skin-So-Soft" oil by Avon. Jack writes that it will remove that awful cyano-type glue from glass, metal, and most plastics: "I recently sprayed some on a counter where the glue had been almost a year, and nothing I tried would remove it. I let the oil set for a few minutes, and the glue came right off."

1990 AMERICA'S CUP COMPETITION

The winners of the 1990 America's Cup FAI FF Competition, as announced by Al Hotard are: Jim Parker in F1A (Nordic), Jim Quinn in F1B (Wakefield), and Bob Gutai in F1C (Power).

A total of 44 contestants scored points in Nordic, 50 in Wakefield, and 40 in Power.

All of the winners spent money and time to travel to distant contests to pile up points, and they each made at least one cross-country trip. That's what it takes. A 1991 rule change using five contests in the totals, not four, will make travel all that much more important.

If you are interested in participating in the America's Cup Competition in 1991, you can get further information from Al Hotard. Contact Al at 1012 Domato Dr., Covina, CA 91724.

HOW I GOT STARTED IN FREE FLIGHT

This is a continuing set of personal stories submitted by the readers about how they got started in free flight. If you have a story that you'd like to share, please jot it down and forward to Bob Stalick, 5066 NW Picadilly Circle, Albany, OR 97321. I will print those of interest. Please keep them short (not over a typewritten page-and-a-half).

Lyle Burt, alias Rip Van Modelbreaker, now of Sacramento, California shared this vignette with me, and now I'll share it with you:

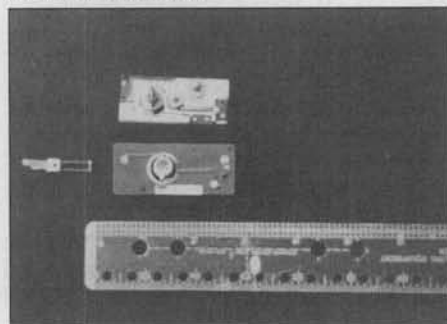
"The year was 1935. The place was Jerome, Arizona, a mining town perched on a steep mountainside. Airplanes were rarely seen over Jerome. There was a small cow pasture-type airport in the valley below. A

friend and I hitchhiked to it once at the tender age of 10. There were two crashes during those years. One was a spin-in during a training flight over the valley. It killed both the instructor and his student. The other crash occurred when a pilot tried to climb over the mountain without circling to gain sufficient altitude. The whole town viewed the wreckage on the shoulder of the highway as this was a big event. These fatal crashes only seemed to heighten the adventure associated with flying. I watched every airplane until it would go out of sight, saw every airplane movie that came to town, and read everything about airplanes I could get my hands on. I would sit on the mountainside above town and watch with envy as hawks and buzzards soared on thermals and mountain waves.

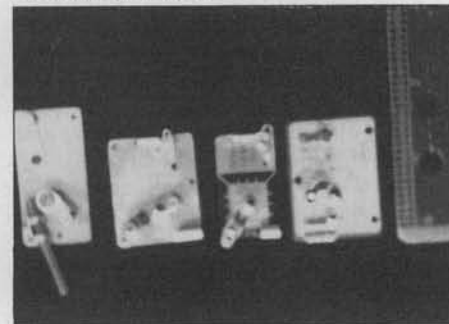
"A magazine, probably *Air Trails* or *Flying Aces*, possibly *Model Airplane News*, ran a plan for an all balsa, hand-launched glider. There was no hobby shop in Jerome, but my father took me to the lumberyard where there were two pieces of balsawood. I bought the smaller one, which was approximately a 2x4 about 36 inches long. I split this into boards with my father's hunting knife, promptly slicing my thumb nearly into two

continued on page 96

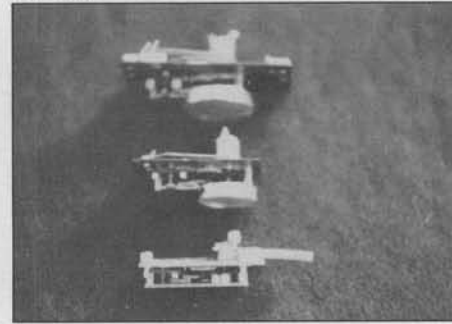
Two timers for small gas models. At top is the Seelig Minicombo four-function. The bottom is the new Starline three-function with pinch-off mechanism, to the immediate left of the Starline. This Starline comes with both the remote pinch-off and a built-in switch.



Four standard timers. Left is the new Starline pinch-off based upon a common camera timer clockwork. The middle two are old style Tatone pinch-off timers and at the right is the newer model KSB pinch-off.



Top and side views of the Starline timers featured in the article. The top one is the five-function, the middle is the three function Wakefield and the bottom is the prototype pinch-off timer.



BELLCRANKS: STOP 'EM OR DON'T STOP 'EM?

In control line flying, the bellcrank is literally the point on which everything else hinges. That helps to explain why more questions received by this column concern the bellcrank than any other aspect of control line aircraft technology.

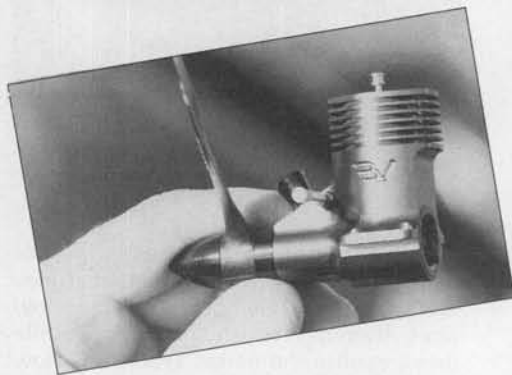
Here's another question on the subject of bellcranks, asked by Paul Forrette, of Ben Lomond, California, who has recently returned to control line flying after a 27-year layoff. As we've said to the many RC flyers who have come back into the CL hobby, "Welcome back, Paul." Now, on to the question:

Just read your column in *Model Builder*.

bellcrank movement. Also, it prevents smashing the balsa ribs, as the crank goes to extremes. By the way, it's a Flite Streak, built from an original kit bought at a club auction. Power is a Silver Arrow .21 diesel, English. Best prop is an 11x7, to slow it down. Those diesels really pull! It's only something to play around with.

"I've been sucked into RC since 1963. In fact, I had not flown CL for 27 years. Time flies, doesn't it? You know what? You never forget! Within two laps it was figure eights, loops, etc., with only a few full laps. Didn't want to get dizzy the first flight.

"Now I recall the first model I successfully



The startling Shuriken .050 engine mentioned in last month's column. Cost is \$200. Catalog available from BV Competition Engines, 1163 Country Club Road, Indianapolis, IN 46234. Tell 'em we sent ya!

the smashing of balsa ribs. However, in the planes I have had occasion to build, that has been the only reason to use the stops.

I generally consider it desirable for the bellcrank to move as far as it can move in both directions. I find that using the full swing of the bellcrank, and matching the elevator travel to provide optimum deflection at the ends of the bellcrank's travel, results in a control system that provides both maneuverability and stability. I'm looking for a control system that allows me to use a fair amount of arm movement to produce turns in the plane, as opposed to just a little twitch of the wrist. A control system that produces rapid elevator movement from only a little bellcrank movement results in a jumpy airplane, difficult to fly level or fly eyes-off.

So I usually set up the plane with the bellcrank in a position to swing freely as far as it can go until stopped by the pushrod, etc. I have not encountered situations in which the bellcrank would tend to bind on full up or full down control; there usually are other factors, such as the pushrod, that stop the bellcrank's movement first.

However, I can imagine a circumstance in which such a binding could occur, which should be evident as the plane is constructed. If it appears that the control mechanism is subject to any kind of binding, then by all means that must be prevented before the plane is finished.

In the case of a bellcrank bind, you can either reposition the components to avoid the bind, or you could use the stops as Paul suggested. If you do use the stops, and are



This PT-19ish "Super Chief" is described by its designer/builder, Tom Dixon, as "a Veco kit with a glandular condition." More info in text.

You gave hints for locating the bellcrank, etc. (Jan. 1991). May I ask a dumb question that has been in the back of my mind for years?

"Does anyone ever provide 'stops' for the bellcrank? Or is it allowed to go as far as the handle will provide?"

"It seems possible to lock up in extreme movement . . . full up or full down. Am I too nervous? Is this not a problem? Does no one use full up or full down in a panic move, or am I the only one?"

"On my last CL model, I glued in plywood blocks on the ribs on each side to limit the

flew. O&R 23, on spark, the 'Tethered Trainer' from *Air Trails Annual*, about 1946. But enough nostalgia; what about the bellcrank 'stop' question?"

First of all, there's no such thing as a "dumb question" in regard to model building . . . and especially not this one. It's a topic we haven't covered here before.

Yes, bellcrank stops have been used by some fliers in some airplane designs. Whether they actually are necessary or desirable probably depends largely on the particular airplane.

I have used the stops a few times to protect

seeking the free travel recommended above, simply try to locate the structural part that stops the bellcrank at a distance from the post that allows maximum travel without binding.

All of my fast combat planes have the bellcrank turned backwards, so that the pushrod arm is on the inboard side of the wing. The reasons for this are twofold in my

observation that the reversed bellcrank, provided that it has been installed with free movement and no conflicts between the leadouts and the pushrod, will not move quite as far as a bellcrank in a normal position because of natural stops provided by the pushrod. This may not apply to all applications.

In conclusion, then, the answer to the

Fox catalog you can get a kit for installing a pressure tap in the backplate for using a uniflow tank. How do you hook up this type of tank, as where I fly now I don't need a muffler?

"Also, do you think the Fox .40 will be enough difference from a Fox .35 in this airplane. The old Stiletto used an O.S. .35 and the new one used a Supertigre .46. I



Contestants and their scale models at a major contest in Poland, trying to ignore heavy rain. Photo supplied by Piotr Zawada, whose pupils placed 1st, 2nd, 5th, 8th, 10th and 13th in the Junior Division. Piotr placed second in Senior with his Miles.

particular airplanes, and they may be worth considering for other planes as well.

First of all, I like to have my pushrod run down the centerline of the plane. It exits from the top of the tailboom rather than out the side through the wing. It is a little cleaner both from a construction and aerodynamic standpoint. In a standard profile plane, the centering of the rod would allow internal controls, possibly through use of flexible RC-style pushrods in a fuselage channel. We have used this in profile racing planes with some success and reduction of external drag. Some centering of the pushrod may be desirable similarly in the full-fuselage planes.

Secondly, turning the bellcrank backwards, and having the elevator horn on the top of the elevator, puts the up line in front at the leadouts, which has a measurable effect on the flying characteristics of a plane expected to perform aerobatic maneuvers. We've discussed this in previous issues. There are long theoretical explanations involving fancy words like "precession" and so forth that we won't go into here, but it does make a difference which line is in front (if no maneuvering is expected, as in a racing plane, the leadouts can be in any relative position or can exit the wing together).

Paul has identified a possible third reason for reversing the bellcrank. It has been my

bellcrank stop question would seem to be: If there is a chance of binding, use a stop. If there is a chance of crushing balsa or getting caught in a slot in the balsa caused by the bellcrank's hitting it, use a stop. If the bellcrank seems to work freely without a bind, and there is no nearby wood to protect, do not use a stop.

By the way, it should be assumed in building any airplane that full up or full down control will be used at some point. I've never known a flier who didn't use maximum control at some time or other, either by design or in a panic situation. We don't want planes that we can't trust to recover from maximum control deflection.

Thanks, Paul, for an excellent question.

In the April edition, we answered some questions from Frank Paskovich of Weikert, Pennsylvania, about the classic Stiletto stunt plane. Frank sent along some follow-up questions:

"With the Stiletto I can get a Smith 5-oz. tank in standard or uniflow. I used standard tanks in all my older models and the profile I recently finished. I never had too many problems except for putting a tank upside down in an inverted Veco Squaw, which I repaired and it flew well (embarrassing). I liked most Veco and Kenhi kits in the old days. Well, back to the question.

"I have a Fox .40 for the Stiletto and in the

always used Fox .35s, Hi Johnson .31s and K&B Torp .19s in the old days."

Here are some suggestions for Frank and others in his situation to consider in regard to the above questions:

1. Use the uniflow tank if at all possible. You will be much more pleased with the flight characteristics. The uniflow tank should enable you to have a steady run from beginning to end of the flight.

2. I'm not sure which version of Fox .40 you have for your Stiletto, so it is difficult to comment on its appropriateness. However, I would recommend that you consider, if you can find them, a Supertigre .46, an O.S. .40 FSR or .45 FSR, or one of the more recent O.S. .40-45 stunt engines. They are more likely to be suited for the size stunt plane you are considering. Be sure that the plane is built light in any case, because I suspect (based on my observations of this design in the past) that you won't have any excess of power with any of these engines if the plane is the least bit heavy.

If the Fox .40 you have is an old one, you should consider the weight of the engine as compared to the power output. Some of the older big-block Fox sport-stunt engines (not the .35) were a bit on the heavy side. If you have one of the new Fox .40s based on the Combat Special engine and used for RC sport and racing flying, the issue is whether

it can be tamed for stunt purposes. I am not aware of any experiments with these in stunt planes and they may be excellent. If you do use it, please write and let us know how things turn out.

3. I would recommend using a muffler whether your site requires it or not, both for esthetic purposes (virtually all competitive stunt fliers now use mufflers) and for performance purposes. Uniflow tanks are excellent when combined with muffler pressure to further steady the run. Putting a tap in the engine backplate would not give you muffler pressure; it would give you crankcase pressure. Crankcase pressure is a much higher pressure and much more suitable for racing or other high-performance flying. It will make your stunt engine difficult to run at a desirable four-cycle setting and more difficult to start and tune for stunt flying.

To use muffler pressure, put the tap into



Members of the "Avia" club in Warsaw, with some of their scale aircraft.

the top of the muffler (when the plane sits upright). Putting it in the bottom makes it vulnerable to plugging up with exhaust oil. Run a line from the muffler tap to the vent tube of the tank, and cap the overflow vent to close the system. You will be delighted with the results!

Not long ago, De Hill of the Tulsa Glue Dobbers asked us to send him a sampling of the newsletters we receive so that he could set up an exchange with other editors. When we got ready to mail the parcel, it turned out to be a pretty big package.

That hatched the idea that a listing of newsletters in the column might be of use to people who would like to subscribe or exchange newsletters with other CL clubs. Club newsletters have a wealth of technical information as well as just lots of good gossip and news. They provide some of the ideas for this column.

Before attempting such a list, we'd like to invite the editors of any club newsletters that we do not yet receive to send us at least one sample of their newsletter and put us on the mailing list if possible, so that we can mention your publication in the column. After a reasonable time has passed for us to make sure that we're up to date, we'll compile the list.

Also, editors of the newsletters that we're already receiving please note: This control line columnist has moved again (this falls into the "It's a long story" category and readers will be spared the details of another tedious workshop relocation!) and the new address is at the end of this column. Please make sure you're mailing newsletters to the correct address.

In the meantime, to provide a little incentive for editors to send us their publications, we're going to start a new feature in the column . . . a little closer look at one "newsletter of the month."

So, grabbing the first one off the top of the current stack, we come up with *Direct Connection*, the newsletter of the Knights of the Round Circle, from Southern California. Definitely one of the standouts among the newsletters received here at CL Central, *Direct Connection* is the work of editor Kenn Smith, an emerging mover and shaker behind West Coast control line model aviation.

The December 1990 edition of the *DC* announces that the new Knights president is Russ Graves. His helpers include vice president Fred Brigeman, secretary Don Hutchinson and treasurer Patty Brigeman.

The newsletter is always packed with information. For example, the December 1990 issue included:

- News on club elections and a schedule of upcoming meetings.
- A report on the previous month's club meeting, including a recap of minutes and a detailed description of the "show and tell" portion of the meeting.
- Letters to the editor about recent competitive events and political matters.
- Reports on recent contests.
- A report on general events at one of the club's flying sites.
- An illustrated guide on to how to cut airplane parts from sheet balsa.
- An article on preparing Schneurle-ported engines.
- An illustrated article on how to build a vacuum former.
- Classified ads.
- A contest and event calendar for the Southwest.
- A 1991 club roster.
- An illustrated guide on how to build racing shutoffs.

Needless to say, the *Direct Connection* is anticipated with enthusiasm here at *Model Builder* CL headquarters. You can subscribe by sending \$8 dues to the Knights in care of Fred Brigeman, 805 N. Mantle Lane, Santa

Ana, CA 92701. Make checks payable to Fred Brigeman/KOTRC.

Another item eagerly anticipated at CL headquarters is the periodic mailing from *MB* engine columnist Stu Richmond, who sends along CL-related correspondence from his friends in Europe. Recently an envelope from Stu contained some new pictures from Piotr Zawada, one of Poland's star stunt fliers and CL promoters.

One photo dear to your CL columnist's heart is of a lineup of planes and fliers obviously ignoring a heavy rain to display their scale planes at a major contest. Piotr reports that the picture is from Poland's largest contest, and his students took 1st, 2nd, 5th, 8th, 10th and 13th in the junior competition, and Piotr himself took 2nd place in senior.

There's also a photo of some happy scale fliers, the "Avia" club team, in Warsaw on October 14, 1990.

The mail also brings some new product news from Tom Dixon, that tireless producer of stunt and sport aircraft and supplier of hard-to-find products.

Tom provided a photo of a classic "Super Chief" plane that he describes as "a Veco kit with a glandular condition." He means that it's enlarged 19 percent to give it a 720-square-inch wing area. It's powered with a Merco 49 and "flies superbly despite its lack of sophistication." It weighs 59 ounces with a Sig dope finish.

Tom reports that Tony Drago, of Control Line Classics, is considering kitting this version of the Super Chief; inquiries should be directed to CLC.

Tom also reports that he is now distributing Graupner propellers, and at this writing in December of 1990, had begun delivery of his 1957-version Nobler kits and his kits of his own modern design, the Charisma, for .40-.50 engines.

Note a new mailing address: Tom Dixon, P.O. Box 671166, Marietta, GA 30066.

We frequently receive contest flyers but too often they are received far too late to be published in advance of the contest. We'd be glad to mention your upcoming contest if you get us the news in time. That means a minimum of five months before the contest.

That allows us to slide neatly into a mention of one upcoming contest that we do know about: The Northwest Regional Control Line Championships on Memorial Day weekend of 1991 in Eugene, Oregon. As usual, the contest will feature all the AMA rulebook events, along with Northwest Sport Race, Northwest Super Sport Race, Northwest Goodyear, .15 Carrier, Old-Time Stunt, Nostalgia Stunt, and Fox .35 Combat. Also of interest to combat fliers: AMA fast combat will return this year with the requirement that working flyaway shutoffs be installed on all airplanes used in the contest.

Details of the contest will be available from your columnist, address below.

Share your club news, contest information, photos, and technical tips. Write John Thompson, 1145 Birch Ave., Cottage Grove, OR 97424.

MB

CORNER *Continued from page 7*

ten cents for a sheet of balsa, but I also paid ten cents for a tube of glue (to save the latter ten cents, I usually made my own glue by dissolving celluloid in acetone, but that is another story).

Balsa also has disadvantages, unfortunately. It absorbs water and fuel, it requires a lot of (usually heavy) surface preparation in order to achieve a smooth, durable, sealed finish, it is brittle, and it is weak. Yes, I first told you it is relatively strong for its weight and now I tell you that it is weak. To defend my credibility, let me explain.

I have tables showing the several physical properties of many types of wood divided by the weights of those woods. The properties listed are stiffness-weight ratio, tensile strength-weight ratio, fiber stress in bending-weight ratio, compressive strength-weight ratio, etc. Compared to other woods, balsa has the poorest or close to the poorest strength-to-weight ratio in most of these respects.

It is easier to find a heavy material with a high strength-to-weight ratio than it is to find a light material that is equally strong for its weight. This seems to apply to all kinds of materials, not just wood. In other words, when we look for lighter materials, we usually find that the strength goes down faster than the weight goes down.

So when I said balsa is relatively strong for its weight, I mean that it is relatively strong compared to other materials of comparable weight. Unfortunately it is not strong for its weight compared to spruce, epoxy/fiberglass, carbon fiber, Kevlar, or structural metals. Similarly, it is not surprising to find that the plastic foams we use for wing cores, etc. have an even poorer strength-to-weight ratio than balsa, since they are lighter yet.

Creative modelers immediately spot an approach to getting around nature's light-isn't-strong policy. We should use the strong heavy stuff, but we will use a lot less of it. Good approach, but it is not that simple. Complications arise from the fact that the cross-sectional area of a structure in compression or bending has a nonlinear effect on its strength.

For example, a thin sheet of steel is much more flexible and will support far less bending load than will a plank of balsa of the same weight, even though the balsa has much less strength for its weight than the steel. The balsa wins in this case, of course, because it is so much thicker than the steel for the same weight.

STRUCTURAL BASICS

The formulas for bending tell us that the strength of a simple rectangular-section beam varies as the square of the depth of the beam. That means if we have a single wing spar that is a quarter-inch deep and, keeping the same material and width, we double it to a half-inch deep, we double the weight but we increase the bending strength by 2x2 or "four" times. If we halve the spar width and double its depth, keeping the same cross-sectional area and weight, we theoretically

double the strength. Neat. Deep spars are definitely the way to go. This is the reason the best designers make wings with a single full-depth spar at the maximum thickness point of the airfoil.

Deep spars are not only much stronger but much stiffer for their weight. Beam stiffness varies as the "cube" of the depth. Double the spar depth and the wing will be eight times as stiff! These interesting subjects will be addressed in a future MD&TS column.

Similar arguments apply to compression loads in long columns. Thickness again plays a major part, since a long part in compression will really fail in buckling or bending. We are indebted to Mr. Euler for the resulting column-failure formulas. Indebted? I hated Euler when I had to study this stuff in engineering.

Let's not sweat the technical stuff here to the point of hating it. Suffice it to say that we need to get considerable depth or thickness into our model structures for weight-efficient design. Obviously, the lighter or less dense the basic material, the easier this is to do and still keep the weight down. If we use dense but strong materials, in order to make light structures we must either make them very complex, consisting of trusses and girders, or we must otherwise fill our heavy-but-strong material full of air, such as making it into a foam.

In tension there is no advantage to thick-

ness. We can rig biplane wings with thin steel wire and come out far lighter (and have less drag) than we would if we put in balsa "rigging" that would be strong enough to take the loads.

For a model wing spar, on the other hand, steel would be too heavy... or would it? In theory, it wouldn't. Neglecting the very practical problems of cost, building time, tools, knowledge, and craftsmanship required, a steel model airplane wing spar could be built which would be stronger for its weight or lighter for its strength than the best balsa spar, because steel has a better strength-to-weight ratio than balsa. It would be very intricate and out of the question for practical models, however.

In practice, we use balsa spars, or better, spruce or composite spars, but never steel spars (with the exception of wing-panel joining rods). We cannot take advantage of the better strength-to-weight of steel over wood in wing spars, for the above reasons. Similar arguments apply to metal fuselage structures, metal skins, etc. In landing gear, engines, and fasteners, as in rigging, we can use the better strength-to-weight of some of the heavier materials to advantage.

Did you ever think of wood as a foam? It is very much like one. I suspect the basic void-free cellulose from different species of wood weighs pretty much the same, including the cellulose from balsa. The amount of

continued on page 63

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BASIC FLIGHT MANEUVERS

Several times in recent months it has been suggested to me that maybe a series on basic flight maneuvers might go down well. In that spirit, I offer the following essay on the care and feeding of Stall Turns, Loops, and Immelmans.

Maybe I should first pass on a pretty simple piece of advice for anyone planning on any sort of competition other than "Fun Fly." If you don't have a rulebook, write or call the AMA and ask them to send you a copy of the '90-'91 Competition Regulations. This service costs three bucks. Rulebooks are free each year to those AMA members who entered a contest in the previous year, but if you had done that, you'd have one and this wouldn't apply, right?

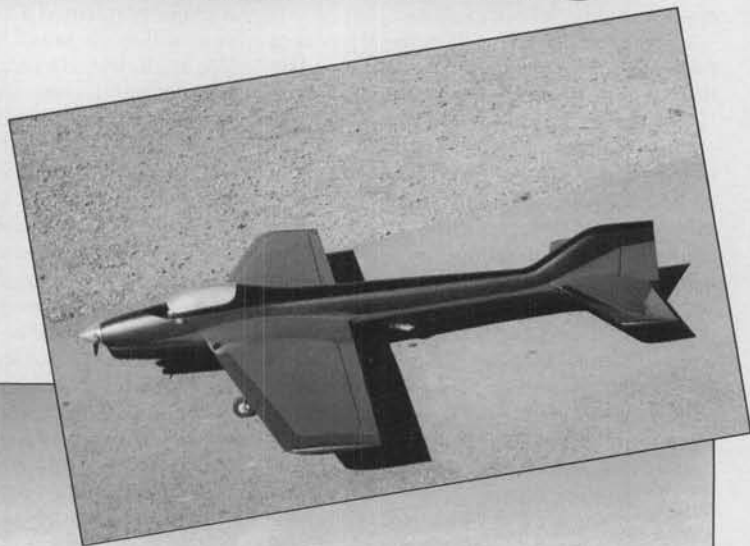
Back to rulebooks. All of the maneuver descriptions and diagrams for all classes (except FAI) are contained therein. Trying to compete without knowing the rules makes less sense than going camping in poison oak country without an adequate supply of toilet tissue, but every year I end up lending and giving rulebooks to people who should already have them. Possibly I have mentioned this before. If so, forgive me . . . it does happen to be a pet subject of mine.

We proceed to the meat of the sandwich, having disposed of the mustard.

Stall Turns, in one form or another (Figure Ms, turnarounds, etc.) are going to be with you as far as you go in pattern. This holds true with a good many of the basic maneuvers. As you progress through the classes, the basic maneuvers become elements, which are combined into more and more complex maneuvers. The class progression is designed to build on previously learned skills at each step on the ladder from Novice to FAI. If you thought of the whole deal as sort of a correspondence course in learning how to fly, with each class as a separate lesson to be mastered before moving on to the next installment, you wouldn't be far from the truth.

The maneuver description for the Stall Turn is straightforward: "The model starts from straight and level flight and noses up to a vertical position, stalls, yaws tightly through 180 degrees, then dives along a parallel path and finishes the maneuver with the plane level at the same altitude as the entry." For this simple and straightforward maneuver, a total of nine possible downgrades exist! (No, I'm not going to list them all. I wouldn't

"Stealth" Cursor by James Carroway sports an unusual paint scheme of dark, non-contrasting colors. Most fliers favor a combination of bright colors for good visibility, but James says he can see his ship as well as any other and has been painting them like this for years.



want to spoil the book for you...) Presumably, in a **double** stall turn, a pilot could wind up with a score of minus 8! I suppose we should all be grateful that zero is as low as the judges are allowed to go.

As always, straight and **level** flight on a heading parallel to the flight line is the key to this one. You can't do this maneuver from a bank, because the airplane will not pull up straight from banked flight. Yes, I know you can fix a lousy pull-up with rudder, but if you know how to do that, you should be able to pull up straight in the first place.

Let me digress for a moment. Every year, I get requests to help people with trim problems. I don't mind this at all, because I really do enjoy the process and the challenge of making an airplane fly straight. It is truly amazing, however, how many times I get handed a reasonably straight airplane that supposedly has a "heavy wing," or "something wrong with the engine thrust," or "maybe a warped whatsis," when what is really wrong is the pilot's perception of what constitutes level flight. How do you tell if you are flying level? Well, I've covered this in detail before, but a real quick and dirty method is to do a reasonably tight quarter loop from what you fondly believe is level flight at half power or less. A straight airplane will come vertical without correction **even without right thrust**. Most crooked ones will also, unless the problem is severe. Check yourself by flying directly away from yourself and doing the maneuver again. You can see wings level from the rear very easily. This is the fast way to separate operator error from hardware malfunction.

Once having mastered level flight, our Novice hero finds the rest is easy. A nice quarter loop (Hey, we already practiced that!), and cut the throttle as the aircraft comes vertical. A little practice will show you how slow to let the birdie get before you bend the rudder over. Every airplane will react a little differently, depending on de-



(Top) Seen at the TOC . . . Steve Helms with his Godfrey Ultimate. (Middle) First place Freestyle winner and TOC rookie, Quique Somenzini (left), and his father teamed up to design and scratch-build their Ultimate entry. (Bottom) Japanese flier Naruke's gorgeous Godfrey Ultimate gets our columnist's vote (and ours, too) for the best color scheme at the TOC.

sign, rudder throw, CG location, etc. Some airplanes may want a tiny bit of throttle either blipped on or left on for a little wind over the rudder, some don't need it, and some have enough rudder power to pirouette like a helicopter. Hey! How about a pattern plane with a tail rotor? Sorry, just daydreaming for a moment. Where was I?

Oh yeah, crosswinds. Even a slight cross-

wind will cause the bird to lean a bit at the top as flying speed is lost. As stall direction is no longer called out in the maneuver description of either the single or double stall turn, stall **with** the lean (into the wind), never against it. Most flopped stall turns are simply the result of going the wrong direction. The return path should exactly parallel the entry path and be not more than two wingspans away. At present, stay tuned to your new '92-'93 rulebook for possible changes here. Ideally, the plane should pivot on its CG as it yaws through 180 degrees. Come back on the throttle smoothly on the downline and avoid jerking on the elevator.

Common mistakes in this maneuver are either over pulling or under pulling to the vertical, pulling up from a bank, and failing to start and finish at the same altitude. In addition, most folks tend to do this maneuver too close in, putting the top of the quarter loop(s) out of the 60 degree upward limit of the aerobic frame. Some people put a little or a lot of vertical line on top of the quarter loop before the stall turn. Some judges like that, and some don't. The rulebook makes no mention of a vertical segment, other than to say that the aircraft must come vertical. This implies that some amount of vertical flight must be demonstrated, or at least, that's what was decided at the Nats Judging Seminar I attended. Personally, I'd try to find out what the judge likes to see, and show her/him that.

In any case, the maneuver should be properly presented. For the single stall turn, maneuver centering is not called out in the rulebook. Some people start the maneuver with the bottom of the quarter loop beginning in front of the pilot, while others displace the start of the maneuver slightly past center. The loop should be fairly large and open, with a constant radius, and the stall turn done far enough to the side that the top planview of the aircraft is **clearly visible** to the judge.

This criteria of **visibility** is one that you are going to run into again and again as you progress in pattern. Briefly put, **it is the pilot's responsibility to present the judge with the best seat in the house**. If the judge

continued on page 100



SOARING AT
**CAPE
COD**

BY DAVID GARWOOD



There are hundreds of slope soaring sites in North America. Some are famous, some practically unknown; some are easy to get to, others requiring a drive and a hike; some are well located for prevailing winds, others soarable only in uncommon wind directions. To me, slope soaring is the superlative way to fly RC aircraft, and Cape Cod is one of the great places to do it.

In the two years that I've been flying gliders, it seems that West Coast and Great Lakes slope sites are well known, but eastern sites are not as often discussed. During those two years I've flown at 14 slope soaring sites in New York and New England. Five of the best of those are on Cape Cod.

The Cape Cod winds and topography combine to create soaring conditions that are good at times for training flights and extended LSF slope flight requirements, and at other times for aerobatics and pylon racing. Two hours from Boston and Providence, Cape Cod is within a half-day drive for people in Albany, Concord, Hartford, Montpelier, and New York City.

ADVANTAGES AND DISADVANTAGES

There are several terrific features which make this place a slope soarer's haven; first is an abundance of good hills. Here dunes and bluffs generally face the sea, and are free of upwind obstructions to cause turbulence. Most have sandy landing areas, some have drive-up access, and some even have rest rooms. All have a good view.

While there is no guarantee of suitable wind conditions on any given day and any given site, Cape Cod gives you an edge because it's flyable from several compass directions. Because the Cape stretches out eastward into the Atlantic, curves north, and then reaches back west toward the continent, it has shore line facing all compass directions. When the wind direction shifts, you can go to another site.

Tourists are welcome here, and lodging is readily available for travelers. You can stay in motels, hotels, cottages, cabins, or bed-and-breakfasts. One motel maintains a launch platform for use by hang gliders and sailplane flyers.

This is a resort area, so in case the rest of the family doesn't love sailplanes, they can still have an enjoyable trip pursuing separate interests like swimming, bicycling, antiques, shopping, museum-going or whale-watch cruising.

There are some disadvantages, most serious is that Cape Cod is crowded in the summer. This makes it difficult to change sites, as parking lots are sometimes filled by noon. One option is go off-season . . . before Memorial Day and after Labor Day.

Dune conservation restricts the use of some sites; the solution is to go to other areas where paths lead from parking lots to launch sites. It is important to stay out of fenced areas and off marked dune conservation areas, as we do want these coastal resources to be available for future generations.

Finally, you may have to share airspace with hang gliders and parasailers. RC flyers must treat these fellows as full scale aircraft, and stay out of their way. Often we set up a marker and fly models on one side and hang gliders on the other.

SITE DESCRIPTIONS:

There are more than 30 beaches on Cape Cod, and at least a dozen have dunes suitable for sustaining a model sailplane in ridge lift. We locate more "new" sites on each trip by using a detailed map to find roads that lead to beaches. One good map is the "Arrow Cape Cod Street & Road Map," available at book stores, grocery stores and convenience stores. Discovering new sites is one of the joys of soaring the Cape, but in case you're short on time, here are a few to start with:

WHITE CREST BEACH - Ocean side, east wind.

White Crest Beach is where I had my first flight over two hours,



(Top) Dave Knight checks control surface movement before launching a Dynafite "Freedom" from the Seascape Motor Inn hill. This site is soarable from 10 to 30 mph west or southwest wind. (Middle) Red Goldberg "Gentle Lady," white Bob Martin "Bobcat," and blue Hobby Horn "Sensoar" are examples of light air ships that serve well as slope trainers. Photo taken at Fisher Beach. (Bottom) Jim Harrigan flies from a hill above Fisher Beach. This slope is flyable in winds of 8 mph or more from the west or southwest. (Opposite) Stan Eames flies a "Talon" at the Seascape Motor Inn in Truro. Cape Cod soaring conditions frequently support smaller, heavier, and faster models than many inland sites.



One of the interesting things about slope soaring is that your airplane spends much of its flight time at or below eye level. Bob Martin "Bobcat" makes low pass at Cahoon Hollow.



How often do you get to look down on your airplane in flight? Sig "Ninja" soars site along the south side of the hill over Fisher Beach.

with a trusty Bob Martin "Bobcat." It's a medium size hill for Cape Cod, about 100 feet high, and there is plenty of parking at the top of the bluff, for those who dislike hill climbing.

To get there, take go east on LeCount Hollow Road in Wellfleet, and turn left onto Ocean View Drive. Go north one mile until you see paved parking lots on both sides of the road. There are trails to launch sites at both ends of the ocean side parking lot, and rest rooms on the land side of the parking lot.

LONGNOOK BEACH - Ocean side, northeast wind.

Longnook has the highest dunes I've seen on the Cape, a fact not lost on the hang gliders, as this is a favorite location for them. You have to climb the hill to launch, but few RC flying experiences compare with flying your sailplane at eye level, 200 feet over the beach and ocean below.

Longnook Beach is at the end of Longnook Road, east from Route 6 in Truro. It has a paved parking lot for 50 to 60 cars.

HEAD OF THE MEADOW BEACH - Ocean side, north-northeast wind.

If the wind shifts to the north, and if it's blowing at 12 MPH or faster, you can find lift just off the parking lot at Head of the Meadow Beach. The ground cover is not airplane-friendly, but there's a sandy landing area on the beach itself.

To find this site, take Head of the Meadow Road east from Route 6 in North Truro, park in the paved lot, and climb the hill to the right. Stay on the trails to avoid damaging vegetation.

FISHER BEACH - Bay side, west wind.

Flying at Fisher Beach takes you away from the crowd. With

access limited by a four-car parking lot at sea level, you have to get there early and walk up one of two 100-foot dunes. The view of Provincetown and the Bay is unsurpassed.

To get there, take Prince Valley Road in South Truro west from State Route 6 to the end. Turn right onto Old County Road, take the second left onto Fisher Road, and go to the end. The soaring sites are the two hills on the left.

Thirteen year old Louis Garwood struggles a bit to keep a Hobby Horn Sensoar out in front of the hill in stiff wind. Note the radio antenna flag and the whitecaps on the ocean.



SEASCAPE MOTOR INN - Bay side, southwest wind.

The Seascape launch site is a few steps from your motel door, a 75-foot bluff facing southwest. While it's not a big hill, it's a good one. I've seen two-hour flights before breakfast, and seen a Douglas Quicksilver fly inverted for 15 minutes. The site features a hang glider launching platform and benches.

The Seascape is open from May through October. Call or write to Chuck Nyhan, owner, for information or reservations. Seascape Motor Inn, Route 6A, Truro, MA 02651, (508) 487-1225.

SELECTION OF MODEL AIRCRAFT

Like any other site, wind speed is the biggest factor in deciding what airplane to fly. In light wind, from 5 to 10 mph, you'll need a floater like an Airtronics "Olympic 650," a Goldberg "Gentle Lady," or a Hobby Horn "Sensoar." The Bob Martin Bobcat aileron trainer works well in 10 MPH wind, and at lower wind speeds it's awful hard to beat a Culpepper Models "Chuperosa."

In moderate wind, from 10 to 15 mph, smaller aileron ships start to show up, like the Bob Martin "Talon," Dynaflyte "Freedom," and the Sig "Ninja." Also suitable are semi-symmetrical polyhedral planes like the Airtronics "Sagitta 600," and Great Planes "Spirit," and larger aileron ships like the Culpepper Models "Callisto."

When the wind speed rises to 15 to 25 mph, you'll see soaring hot rods like the Jerry Bridgeman "Snipe," Bob Martin "Coyote," the Douglas Aircraft "Quicksilver," and the Fly by Night Models "Shadow."

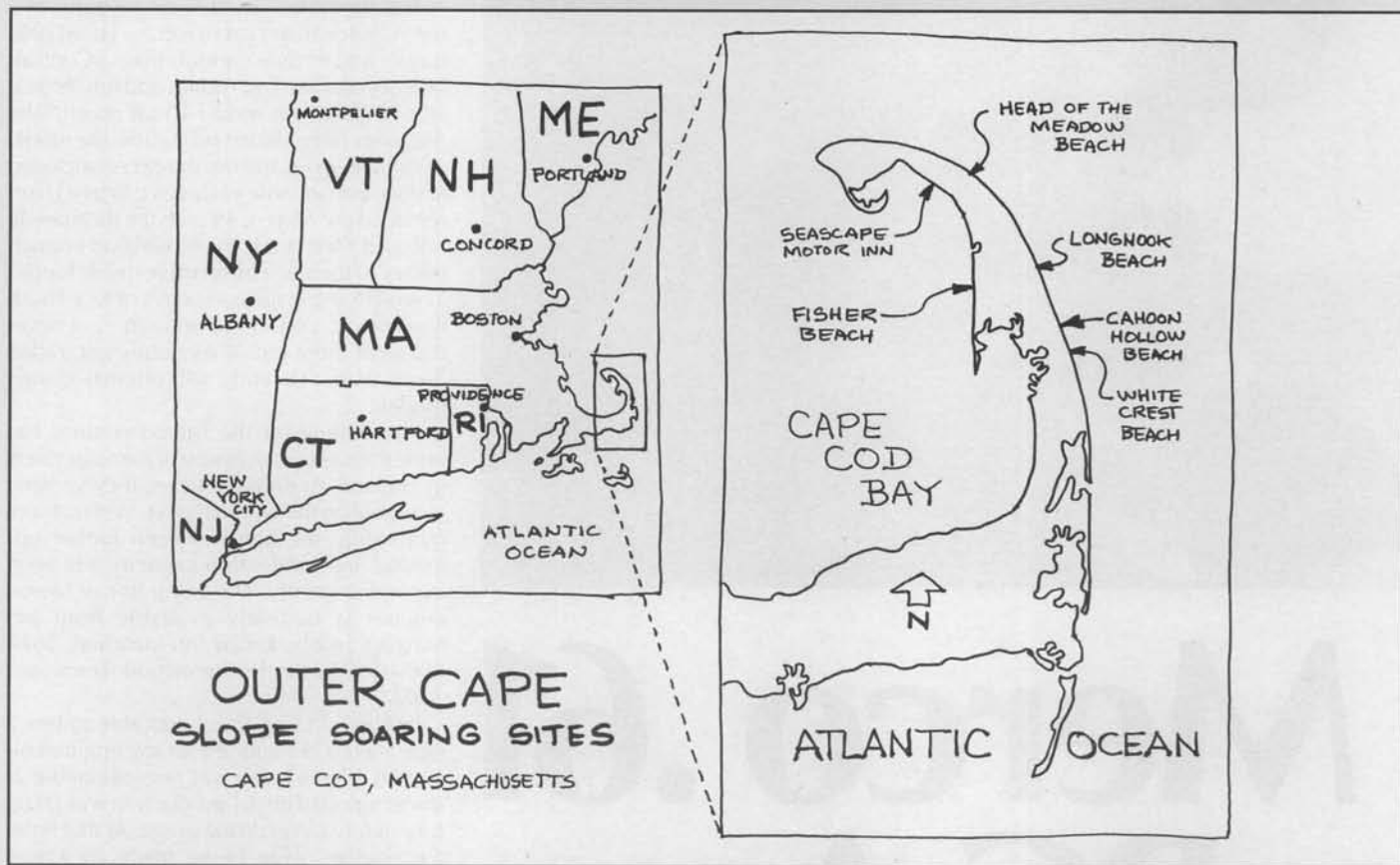
These examples are not ex-



Bob Powers prepares to launch a four-meter Alpina while Sal DeFrancesco mans the controls at the Seascope Motor Inn.



RC glider pilots pause to watch a parasailer launch from Longnook Beach, before moving further along the ridge to avoid an airspace conflict. Photo by Don Coletti.



haustive, of course, and you should fly what you have and what you know how to fly. If you're used to inland sites you'll find that Cape Cod conditions will support heavier and faster models than many river valleys. My own most memorable Cape flying day was with a Quicksilver in 30-knot winds (34 mph). Small seacraft were warned to stay in port, but small aircraft were in their element.

REFERENCE INFORMATION

An Outer Cape recorded weather forecast is available by calling (508) 255-8500, and there are two local hobby shops: Hobbytown in Hyannis, (508) 771-0363; and New England Hobby Shop in Dennisport, (508) 393-2232.

For more local information, contact the chambers of commerce in the towns near the sites mentioned:

Orleans Chamber of Commerce, Box 153, Orleans, MA 02653; (508) 255-1386.

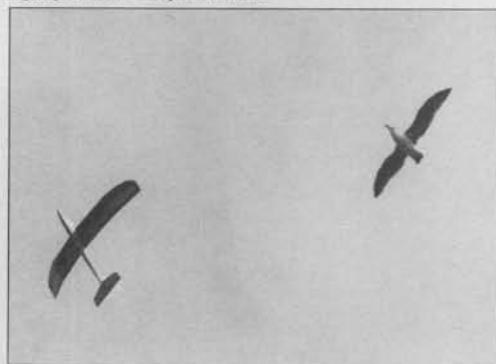
Truro Chamber of Commerce, PO Box 26, North Truro, MA 02652; (508) 487-1288.

Wellfleet Chamber of Commerce, PO Box 571, Wellfleet, MA 02667; (508) 349-2510.

A single issue of "The Original Cape Cod Guide" is available for \$2.00 from Prescott Visitor Magazines, 495 Station Ave., South Yarmouth, MA 02664; (800) 458-4881 or (508) 760-2027. My copy lists the location of more than 60 beaches, and gives general street maps of 17 towns.

MB

A Great Planes "Spirit" cruises with a gull. If you want a lesson in slope soaring, watch the gulls. They routinely demonstrate flying skill and agility that we only dream of.



Products

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Merco .61 RC Aero

BY STU RICHMOND



Parts teardown shows a basic non-Schnuerle engine of near-conventional design.

If memory serves correctly, I bought my first Merco in the early 1960's from MB reader Cliff Piper at the RC flying field in Westboro, Massachusetts. It was a brand new Merco .49 that had just come from England . . . replaced a tired and well flown green-head K&B .45 that had been pre-massaged by engine expert Harvey Thomasian. . . Harvey knew how to make the K&Bs idle well in those early (and primitive) RC days.

The new Merco .49 went into my two servo high winged cabin job . . . I used only rudder and throttle controls from a Control-laire reed radio. Full rudder and full throttle would make the model spiral down. The release of full rudder would allow the model to straighten out and use the excess airspeed to do a loop in those early days. When I later replaced the Merco .49 with the then newly released Merco .61, the model had enough power to then do **consecutive** inside loops . . . wild flying in the early days of RC! Those two Merco engines ran and ran . . . I never did wear them out. They finally got traded away with that early RC original design model.

The tooling for the Merco engines has gone through a succession of manufacturers in England. At different times, they've been available on the world market. With present ownership, the line has been further upgraded and production capacity has been expanded greatly. The entire line of Merco engines is currently available from Jim Martin's Hobby Lobby International, 5614 Franklin Pike Circle, Brentwood, Tennessee 37027.

In 1985, in England, I was able to buy a new Merco .49 and .29 for my engine collection. The .61 size was non-attainable as it was reported all .61 production was going for military target drone usage. At that time, the engines were being made by Forest Engineering, which acquired all tooling from D. J. Allen Engineering.

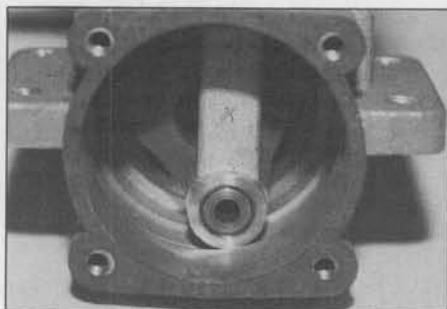
British pen-pal Ian Russel writes as follows: "I do know Merco was started by Bill Morley and Ron Checkfield, with Ron doing the tool and jig making, or certainly the majority of it. Ron is one of nature's great, accomplished, talented men. His ability to think through engineering problems and retain complex concepts and details in his head, produce finished machinery, etc., is just awe-inspiring. If you come (back) to Great Britain I will arrange for you to see his machine for making glow plug coils. Ron and Bill passed Merco to Dennis Allen, who was making A. M. diesels, and eventually Forest Engineering owned it, prior to selling to Reg Hills. Reg tells me there are other past

owners..." So much for past history.

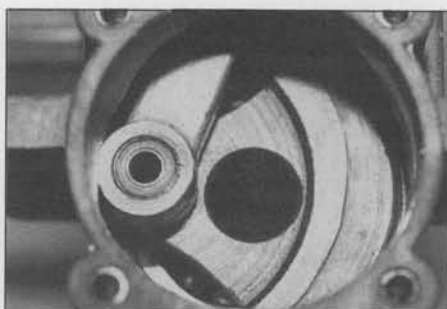
Today, the Merco engines are produced by Premier Engines and Plastics in England, and their Vernon Smith was kind enough to supply the following most interesting information that applies to the Merco engines Hobby Lobby now sells. Vernon writes: "The overall engine design is unchanged,

but the old-fashioned cast iron piston and steel liner have been changed to ABC. The piston is cast in-house using, the very latest alloy with 29% silica to give excellent wear characteristics. The resultant four-fold reduction in weight of the piston has increased the power by about 15% and reduced the transmitted noise and vibration levels be-

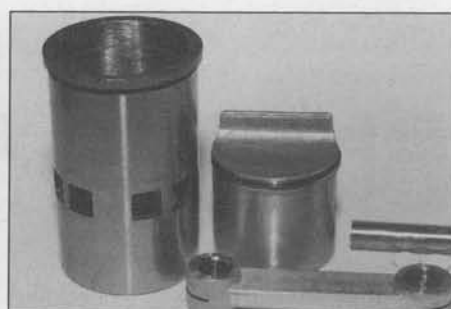
Merco .61 RC Aero engine. It's a classic glow engine design . . . you older readers may remember the early engines had two glow plugs . . . one behind the other for added reliability in those early days when plug element wire wasn't as fine as it is today. (This older reader purchased a Merco .61 for his Max Beauchamp "Viper" pattern



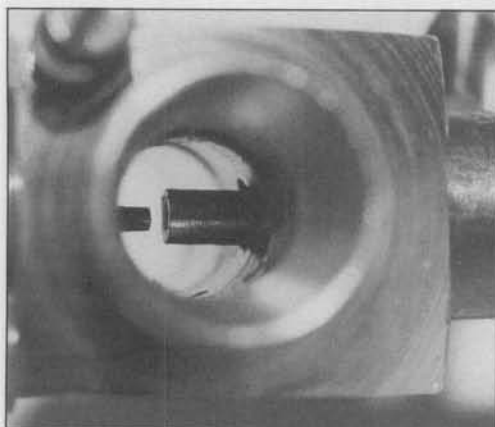
With the connecting rod at vertical, this photo gives the clue that the axis of the cylinder is off-set towards the exhaust side of the engine.



Here the engine is on its upward stroke and the conrod is less vertical . . . its design theory in action.



Unless the honing marks are pronounced inside the cylinder, the piston ring (just below the piston's crown) will never wear in properly. Performance will suffer.



Fuel line fits on the brass nipple at top right. Incoming fuel exits the spray bar (after high speed metering) and enters the engine by spraying out the tiny hole in the end of the spray bar. Carb is wide open in the photo. As the carb's barrel is rotated to low speed by the throttle servo, the barrel follows the machined incline (on the photo's left side) as it moves into the carb and partially closes off incoming air. The barrel carries with it the idle needle valve who's tapered tip will, at the right time, enter the hole in the end of the spray bar to lessen further the fuel flow as the incoming air is lessened. This gives a proper air/fuel ratio for reliable low idle speed, which we need for landings, taxiing, touch-and-goes, etc. Engines that don't idle well rate poorly with Stu.

yond belief. The smaller .30, .35, and .40 engines subsequently respond quicker and smoother to the carburetor than before. We chose to stick with the original loop-scaevanged (cross-flow) configuration to retain the characteristic high torque but lower rpm and wide power band.

"The up-dating of the .30 and .35 engines and the design of the new .40 was carried out by my own engineers. Hobby Lobby is stocking all 15 aero and marine engines which we produce and is looking at the new 5cc diesel which we have just produced. The .50 and .61 engines are unaltered. They retain the aluminum piston, steel piston ring, hardened steel liner and twin ball bearings and should be as good as ever."

Isn't it nice to hear direct from a manufacturer about their current design/construction philosophy?

Let's look over/around/inside this

ship back in 1965-66. The twin-plug head, as we recall, was supplied as an included accessory item with the standard single-plug equipped engine. It was easy starting, powerful, reliable, and very smooth transition from idle to full throttle.-wcn.)

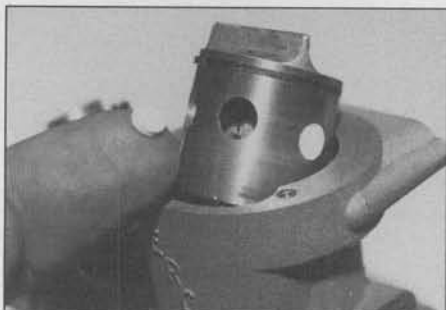
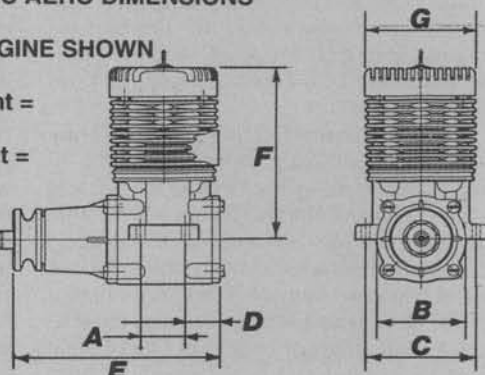
Merco engines are guaranteed for life against defects in materials and workmanship (naturally, normal wear and/or abuse are not covered). USA repair service is by Hobby Lobby. Being made in England, the *continued on page 103*

MERCO .61 RC AERO DIMENSIONS

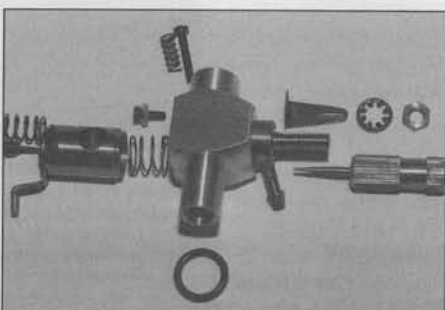
GENERIC ENGINE SHOWN

Engine Weight = 13.7 ounces
Muffler weight = 1.9 ounces

A = 15/16"
B = 1-7/16"
C = 1-13/16"
D = 3-1/4"
F = 3"
G = 1-5/8"



White plastic pads retain the wrist pin in place. The front one is on Stu's fingertip.



Text tells how to easily do partial carb tear-down for cleaning.



Few engines have the glory of international competition successes in their past history as does the British built line of Merco engines . . . here's the .61 during break-in.

BUILD A 'TOPCAT'

A new friend in indoor, Wally Miller, recently sent me several newsletters from the early sixties. They concern a Los Angeles indoor group called The Wilmington Indoor Club. As stated in their newsletter, there used to be no distinction as to ceiling heights for indoor. So, a person who flew for a record in a 25-ft. building had little chance against someone who put up flights in a room with a 100 or 150-ft. ceiling.

The idea of having categories for each of three heights goes to Tom Finch, who proposed having Category 1 (up to 35 feet), Category 2 (up to 100 ft.) and Category 3 (over 100 ft.) ceiling heights. This was presented to the AMA in the form of a rules proposal. It was originally called the Wilmington Proposal. Dick Kowalski of the Detroit indoor club and Pete Sotich of the Chicago indoor club endorsed this proposal, which was finally called the Detroit-Chicago-Wilmington Proposal, and was presented to the Free Flight Contest board on April 29, 1960.

It was also during this time that Bud Tenny was busy promoting indoor modeling in Texas and writing his "Indoor News and Views." Out in California, Wally Miller came up with the idea of an Easy B category, destined to become the most popular indoor event. At one January 1961 Wilmington meet, Jim Kagawa shook fliers up, coast to coast, with a flight of 14:00.9 in Class C Stick. This 35-foot indoor site also saw Lee Hines push the handlaunch glider record up to 36 seconds. At their November 1961 trials over 80 people attended. Indoor was on its way to a resurgence.

ULTRA LIGHT COVERING CEMENT

We are always looking for new and better covering adhesives for ultra-light plastic film now being used for Intermediate Stick, Pennyplane and Easy B. I wondered if hair spray might work? A search of the medicine cabinet turned up an interesting product. The name is Biotin Spray Gel. Actually it is not a gel but a clear watery liquid, sold in a pump spray bottle. It is water soluble and can be painted on the structure frame with a small brush. It seems to work quite well for sticking the film to the frame. If you try this

or a similar substance, let me know if it works for you.

NEW PRODUCTS FROM IMS

Lew Gitlow of Indoor Model Supply has a new catalog of indoor supplies and kits. One of the new products is a brass torque meter with adjustable zero set point and a drilled clip for quick attachment to your flight box. The model B Meter has a quick release for wound motors.

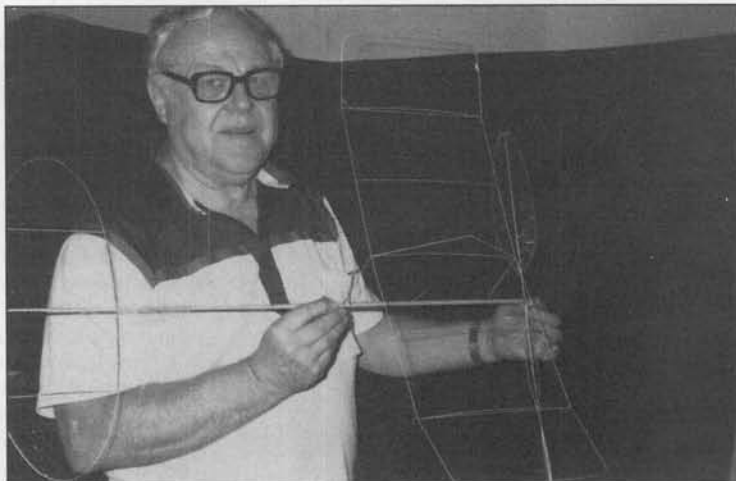
One of his new kits contains two easy-to-build "Class Room Fliers." All materials for building these two eight-inch models are included. A second kit is the Kimberly Sky Rider Peanut. This kit contains: select balsa rubber strip, lightweight tissue covering and three-view drawings of full-size ultralight aircraft. The finished model weighs 2 grams. Send for Lew's catalog by writing to: Indoor Model Supply, Box 5311, Salem, OR 97304.

Mr. Gitlow was a member of the Wilmington indoor club (mentioned earlier) and started Micro Dyne model supply many years ago. He sold out to another supplier but got back into the business later as Indoor Model Supply.

TOP CAT 90

Bob Randolph of Loma Linda, California, has been flying indoor duration models for

many years. He has been on U.S. F1D indoor teams much of late and rates consistently among the top four indoor duration fliers in the world. Several months ago, Bob



(Top) Bob Randolph with his Top Cat 90 microfilm duration model, which has just set a new Category 1 world record of 30 minutes, 21 seconds in a gym in Loma Linda, CA, with a 25-foot ceiling. Handling a model this fragile requires total concentration. (Above) Airline pilot Paul Avery with his super-flying Curtiss Robin Cocoon scale. It is covered with Ultra Film and flights average over two minutes.

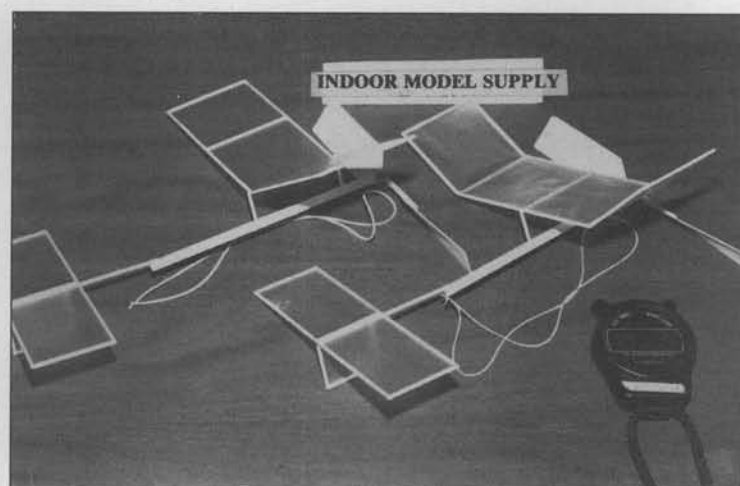
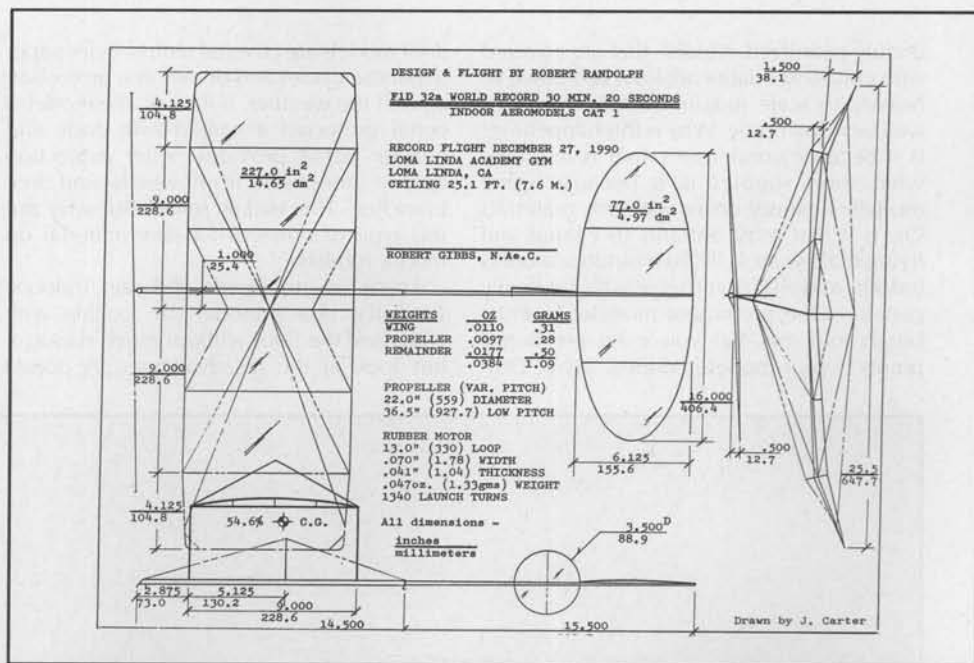
set a new category 1 record of 25 minutes, 20 seconds with his Top Cat 90 model. This Microfilm craft features a variable pitch propeller and was powered by Ed Dolby's

FAI Tan rubber.

Bob recently called to say that he almost broke the world's record. Actually the existing record time must be exceeded by 2% for a new record to be recognized. The time Bob flew was 29 minutes, 24 seconds; the time he needed to better was 29 minutes, 29 seconds. You can see how close it was. The flight was made in a school gymnasium in December when the air is not particularly good. The model was at the ceiling in two minutes, and only bumped four or five times during the entire flight. A 14-1/2 inch motor stick was used and the center of gravity was at 45.6% of the wing chord. Another attempt will be made soon, with much success, I am sure.

ULTRA FILM CUTTER

Dr. Plenny Bates is now offering a hot wire Ultra Film cutter. It is based on a cauterizing unit used in surgery. The cutter comes with instructions for use. It is wireless, portable, and adjustable from .85V to 1.65V at the tip (.9V cuts film and will brown



(Top) Bob DeShields eyeballs the alignment on his Easy B model at the Navy/Marine Corps Armory in Los Angeles. (Above) Wally Miller's indoor setup. Model box is of 1/4-inch foam core. Wally's Easy B weighs .023 oz.

(Top) These classroom flying models come in one kit from Indoor Model Supply. Owner Lew Gitlow says these 8" models are ideal for beginners in indoor modeling. (Above) Los Angeles illustrator Otto Kuhn built this little Thomas Morse MB-7. It's sprayed with Floquil railroad colors. His work is meticulous.

balsa with prolonged contact). The battery life is limited to about 30 minutes. Send \$1.00 and an SASE for the info packet. Complete unit cost is \$15.00 postpaid in the

continental U.S. Write to Plenny Bates, M.D., 2505 White Eagle Trail S.E., Cedar Rapids, IA 52403.

CONDENSER PAPER PENALTY

From observations at local contests and phone conversations with modelers across the country, it is becoming evident that scale and Peanut entries in contests are being

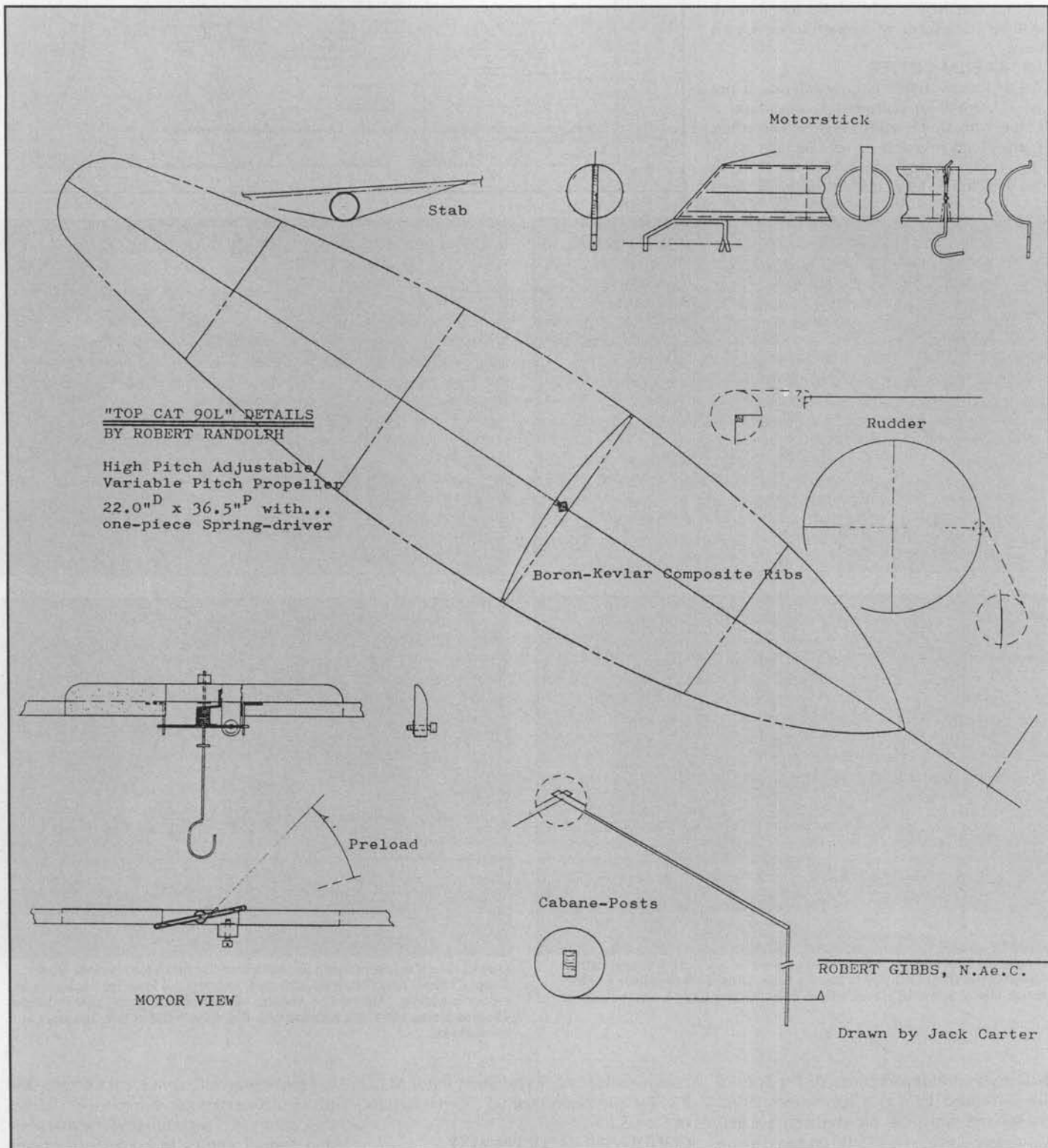
unduly penalized. Models that are covered with condenser paper are knocked down so heavily in scale judging that they may as well be left at home. Why is this happening? Is it because condenser paper is in somewhat short supply? Is it because some modelers cannot cover with this material? Or, is it that most entrants in Peanut and flying scale want to fly their outdoor models indoors as well? I don't agree with this heavy penalty. One prominent modeler in Pittsburgh told me that you even get bonus points if your model is doped. Why? Out-

door models are covered with heavier paper (Japanese tissue) and doped as a protection against the weather. If it rains, the model is better protected if coated with dope and heavier paper provides better protection against punctures from weeds and tree branches. This makes sense. But why put this type of unneeded heavy material on indoor models?

There are no weeds and rain indoors. True, the heavy model can collide with walls and the floor without much damage, but look at the disadvantages. A doped

Japanese tissue covered model flies at about twice the speed and half the duration time of a condenser paper covered model. I'd like to see Peanut models fly longer and slower. It's more scale-like.

If the condenser model is a ghost, I can see the penalty. But if it has a good amount of scale detail and the paper is colored (dyed) and is scale-like in appearance, why should it be penalized? Write with your feelings on this subject. I'd like to know. Write to Ken Johnson, 16728 Bermuda Street, Granada Hills, CA 91344. See you next time! **MB**



MODEL DESIGN *Cont. from page 51*

air each species of tree incorporates into its cell structure makes the differences in weight between types of wood. Balsa has big pores compared to heavier woods, and light balsa has bigger pores than heavy balsa. We get an unasked for demonstration of the porosity of balsa when we dunk a balsa model seaplane. The weight of water they can absorb is amazing.

Wood is a better structural material than most manmade foams. For one reason, wood has a grain, so it is stronger in one direction, and most foams are not. To use big words, wood is anisotropic and foams are isotropic.

PLASTICS

The styrofoam, beaded foam, polyurethane foam, etc. we use for model cores give us the depth we need in our structures, but these foams are made from cheap plastics whose basic strength-to-weight is not the best. Further, their random pattern of voids results in a strength-to-weight poorer than that of the basic plastics from which they are made. Therefore we seldom use foam as a structural material by itself. We only use it as a spacer to get balsa, fiberglass, carbon, or other structural material out to the surface where the greater thickness of the structure will give better strength and stiffness; and we use it as a support for the thin surface material, to keep it from buckling.

Speaking of foams, I ran across a foamed

PVC product the other day. It goes under the trade name of "Sintra" and is available in boards of various thicknesses, all having smooth, dense, integral PVC skins. It looked nice, but it didn't feel nice when I lifted a sheet of it. Its density turns out to be about the same as hardwood and it is far weaker than wood, so Sintra is not on my list of materials for use in building models.

I like innovation and challenges, but I and other inventive modelers are not seeking alternate modeling materials just to be different. "Better" is the name of the game. My search is mainly in the field of plastics, since plastics are much lighter than metals, and the cross-sections can therefore be larger to gain better structural properties for the same weight. Many modern fibers, such as Kevlar, are plastics. These certainly have a place in model building, but for now let's concentrate on non-fiber plastics.

Different plastics vary greatly in their strengths, but relatively little in their densities. Mylar has excellent strength and durability, but most glues and paints won't adhere to it at all well. I have used eight and ten mil Mylar to cover wings and fuselages. The result was strong, light, rugged structures, but I had trouble making good bonds and joints.

POLYCARBONATE

Two months ago, I reported on the use of fluted polypropylene in models, under the trademark "AirCore," by U.S. AirCore in

Texas. In connection with that review I mentioned polycarbonate, a less known but excellent plastic. It is clear and is used for windows, etc., but it is not brittle like acrylic. Of all the plastics, polycarbonate has the most appealing balance of properties for use in model airplane structures, in my opinion.

It is stronger than most common plastics, more rigid than many, and it is very durable, tough, impact resistant, tear resistant, and puncture resistant. It can be cold folded readily without cracking. It is thermoformable. Having no grain, it does not split. It is nonabsorbent, fuelproof and waterproof.

Polycarbonate provides excellent adhesion for most types of paints and can be strongly bonded by most types of glues. Polycarbonate-to-polycarbonate or polycarbonate-to-balsa joints can be rapidly made by using methylene chloride solvent as a cement. These joints are invariably as strong or stronger than the basic materials.

Polycarbonate is not available in foamed form, to the best of my knowledge, but is available as a cored board in several thicknesses, where the total board has a density comparable to medium balsa. The configuration of the board is similar to, but structurally better than, corrugated cardboard. This "fluted" board stock is sold by plastics distributors in all major cities under the trade name "Polygal."

The thinnest Polygal board is currently *continued on page 63*



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PYLON

BY WAYNE YEAGER

RUNNING A SUCCESSFUL RACE

I've been asked from time to time what it takes to run a successful race. Race management is not the most difficult task in the world, and if set up properly, it is a breeze, providing of course, you have light wind straight down the course, warm temperatures, timers who never miss flipping a lap card and never flip more than one at a time, flaggers who are exact, no one being lapped, no dead-heats, and pilots who smile when they lose while sugar drips from their mouths.

This happens all the time in my experi-

witnessed too many races where one person is responsible for the entire course operations and many starters do an admirable job but they just can't see everything. They may be watching a close race around pylons 2 and 3 and have no idea of what's happening at 1.

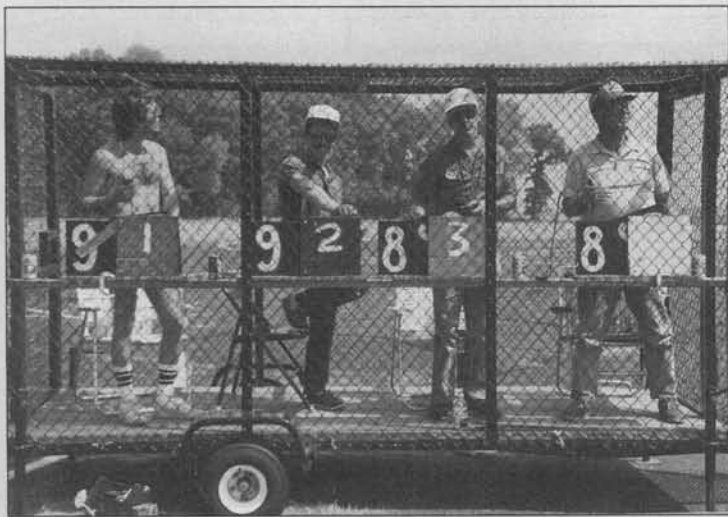
An assistant to the starter adds dimension and greatly reduces the chance for missed calls, resulting in less arguments because race results are more accurately called.

As many of you are aware, wifey person/lover is my best starter and I asked her for

ished and the race results are determined by the timers' clocks.

Never, never do this!!! If the lap counters perform well, the clocks should verify what the starter and assistant starter saw as the results. Starters who do not watch the action are only flag wavers. A good starter with some practice, will be able to tell the order of finish without consulting the stopwatches. No kidding!!

To help a starter, repeat the ID colors in your head as the flag is dropped on each plane, e.g. "red, blue, checks, white." This



Lap counting at races is not too tough for some. In this shot from the F3D Team Trials at the Toledo Weak Signals field, you can note the lap cage is equipped with wheels for easy movement, lap cards as outlined in last month's issue, chairs for the lap counter/timers, plus two who are intent on their chore and two who are intent on the camera.



In this shot from the 1990 Nats, the sun is behind the planes, making it very difficult to identify colors from the Number 1 pylon. Binoculars are very helpful in sorting this all out.

ence . . . and if you believe this I do have a choice piece of property for you . . . Actually, it's more like, "my flagger is too late," or, "I'm not getting a shutter," or, "I lapped that guy," or, "he didn't lap me, I beat that bum," or, "you gave him a nine lap time," and so on, and on, ad nauseam.

To be successful, you need eyes that see in all directions, front and back. As this type of person hasn't been seen since Rod Serling departed, we must utilize enough people to cover that same area. One thing I firmly believe in is "an assistant starter." I have

some hints and kinks which are as follows.

When Karen started in this type endeavor, I told her, "A good starter is one who always knows which plane is in the lead," and I still believe in that philosophy. She worked a Nats without an assistant and things went well, but since adopting a starter/assistant-starter setup, race operations have really improved. The starter should watch the lead plane for the entire race and note the laps flown. That way the heat winner is never in doubt. Some starters drop the flag and then count blades of grass until the race is fin-

ishes. It is not necessary to remember who belongs to which plane, just remember the finish colors.

If a close race is heading for the finish line, tell your assistant to watch the finish to verify the results with you. If the times do not agree and you are certain the finish was different than the stop watch order, call it as you saw. Stop watch results are based on human reaction and can be off a slight amount.

Identifying airplanes should start with the top side towards pylon #1 and pick out

something that is unique to each one, e.g. if two of them are blue but one has red checkers and the other white stripes, call one "checkers" and the other "stripes." Ignore using the blue color because it only confuses. Try to find something on the wing to use in ID'ing because the wing tends to stand out when in the air.

After choosing the identification for an individual airplane, try to use that same identification each time. Timers and pylon judges will soon recognize the plane as soon as it is held in the air, especially if it was something unusual like "puce" or "rainbow." We once had a plane at the Nats built by Pete Reed that had about 10 colors on it which soon became known as "Junk" (no offense Pete, I liked it!).

Write the ID color on the heat card for reference and make certain the airplane tops are shown to pylons 2 and 3 plus the lap

Form 1 it could be: "We're using a 90-second clock and the flag will drop when the hand reaches zero!" This all sounds academic but there really are some pilots who do not hear the clock statistics at pilots' meetings, so reminding them eliminates some confusion.

Always conduct a radio check before the start clock is put into operation. In the heat of racing, people do forget so tell them to turn their radios on and make them show you they work. In the case of Form 1, you can conduct this test after the start clock is running to save time, because there are usually a few seconds before anyone cranks on an engine, which is enough time to check radios. Wife/starter says something like this for Quickie and Quarter, "OK, you're on the clock, it's 90 seconds, go when ready, make sure your radios are on and working!" After the first round, drop the clock time stuff and check for radios only to save your voice.

If it's a case of "go-when-ready," check with each pilot before dropping the flag. Do not spend much time on this. Start with each pilot as they reach their flying position and if a pilot is staring intently at

tell if they are ready just by looking at them.

In addition to the above, the starter must keep an eye on the clock. Do not let time run out without dropping the flag. Do not wait for someone who is still setting a needle or is still starting their engine. When the clock hits the 90 second mark, the flag is activated, however, if the clock has not expired and someone is still setting a needle, you are obligated to wait until they are ready or the clock expires.

As the planes head for Pylon 1, have the assistant starter watch to make sure each gets a signal for every lap. The starter should keep an eye on the lead plane and watch for lapped planes. Tell the assistant starter to make sure each plane gets only one signal. Occasionally, the Number 1 people will mix up two planes, resulting in one getting no signal and another getting two signals. We've seen a plane with three signals, so don't think they can't get mixed up at Pylon 1. Identifying planes from Pylon 1 is tricky business, especially if early in the morning with the sun low in the sky. At last year's Nats, we had to use two pairs of binoculars at Pylon 1 because with the lighting, all planes looked black in color.

The assistant starter does not have to be concerned with lanes when watching for signals from Pylon 1. Just watching for the correct number of signals is sufficient. Another benefit from this is, the assistant



This is Teresa Dlouhy, Pylon 3 Judge at the '90 Nats. Note the clipboard and paper used to write down the model ID colors for each heat.



In this photo from a Virginia Beach Nats, note the starter has hesitated slightly before starting the race and each caller is looking directly at her, indicating they are ready to launch.

counter/timers. Provide the pylon judges a pad of paper and a writing stick, and as planes are identified, have the judges write down that ID color or whatever is used, so if an infraction occurs, they can check the correct identification when calling in the cut. Nothing is worse than someone calling in a cut on "red" when no plane was identified as "red." As the heats prepare to fly during the first round, remind the pilots of the time being used on the clock, such as used in Quickie or Quarter: "It's a 90-second clock and we will go when ready!" For

his plane, they are ready to go, therefore, don't spend time trying to get their attention. Some starters also check with the callers if time permits, however, this takes time while engines are roaring (and burning) so we do not check the callers this way. What we do is; starter holds the flag high with one hand while the other hand is holding the lower corner. Hesitate for a moment before dropping the flag. During that hesitation, check to see if all the callers are looking at you. If so, they are ready. Like some pilots, there are callers who do not look at you, but you can

starter will be able to tell when a cut is being called in if they note a no-signal condition; in fact, they can usually see which plane did not get the signal and start the process for putting up a cut while the cut-call is coming in, which is very important for fast cut display. There is nothing worse than displaying a cut a lap or two after it occurred. It is super important to speed this process any way possible and one item I find helpful is, when using radios for communications, hang one in the timer cage so the timers can hear the cut call. Sometimes they will display the cut

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at the same time it is being called out by whoever you have filling this function.

A helpful hint here is to tell the lap counters to watch their plane as it approaches Number 1 pylon and to note whether they received a signal. If not, they can be prepared to do one of two things; display a cut being called in, or, document an argument from a caller that this particular plane did not get a flag on lap so-and-so.... Or a reverse of this, if the lap counter watches each lap, they can verify that their plane did indeed get a signal each lap when a caller may indicate they didn't. This really helps sort out arguments from frustrated losers. One note of caution here, though; if your lap counters are watching for signals, tell them to never display a cut unless told to do so by whomever is responsible for that function, which is usually the starter.

You will always get arguments about how fast cuts are displayed because there are many callers who do not note them immediately and will swear they weren't there when they were actually displayed two laps earlier. Some callers will never admit to their pilots that they made a mistake. The poor pilot doesn't know what's going on because he/she is watching the plane, so this is really a good opportunity for a caller to blame his mistakes on the workers. Confirmation between two workers that, yes he did, or no he didn't get a signal, usually ends most arguments.

A starter who is communicating with the head judge at Number 1 pylon should always acknowledge a cut-call. A simple, "got-it," will usually suffice, otherwise the judge at Number 1 will never know whether the call was received, and acknowledgment assures cut calls are not missed.

A helpful hint here. The starter or assistant should have the lap card in hand, and if a cut is received, the person with that card should put an "X" next to the pilot's name who received the cut. Make sure the mark is put next to the plane who's identifying color was called. A "cut red at one" should result in an "X" being entered on the card next to the "red" airplane. No way to mix cuts up here if this is followed. In addition, the person handling this chore can glance at the cut boards and note if the cuts were displayed on the correct lane.

Some starters let their assistant handle the radio work to free themselves up from wires or radio's stuck in their ears, however, the starter is the head official and should always know immediately of any problems on the course and should be the person with the radio. If an assistant is being utilized in some manner, give that person a second radio to perform their functions.

The above are only a few of the items helpful in race operations, however, I know from experience. If the work crew is performing well, the CD has an easy job and I firmly believe the key to success starts with the starting crew. If you are in doubt, come to this year's Nats and see for yourself.

Next month, maybe a new easy-to-build starting clock. **MB**

MODEL DESIGN *Cont. from page 63*

4mm (about .17 in.). This is a useful size for us, but Polygal half that thick would be even more useful. If we convince the manufacturer that there is sufficient market, I'm sure they would extrude a thinner board for us.

Cored polycarbonate board provides the depth of material we need for structural efficiency and light weight in many model assemblies. Polycarbonate is also available in many thicknesses of solid film and sheet from .005 to over a quarter of an inch, and it is available in round and square tube stock in many sizes. An all-polycarbonate semi-monocoque model airplane may be practical, using square polycarbonate tube for stringers, with polycarbonate skin cemented to them.

DURABILITY

I have been using a little bit of polycarbonate, for special applications, in my models for years, but I'm now beginning to experiment with it seriously as the basic structural material. My main objective here is durability. I think we will be able to build much more rugged, crash-surviving models from polycarbonate than we can from balsa or our present composites.

Don Lowe has said in his column, on several occasions, words to the effect that we can't build good light models that will survive crashes, so why try. I have great respect for Don, and I can understand that if one's chief goal is winning pattern contests, then building more durable models is of minor interest. I don't buy his acceptance of crash damage as inevitable, however. The models I design are already more damage resistant than the average, and I can do much better yet, without adding weight or otherwise degrading the model.

For that matter, more-durable models could end up lighter than less-durable models. Which has the best chance of surviving a fall onto a carpet, a raw egg, or an egg shell full of mercury? The lighter the weight the lower the destructive kinetic energy in a crash.

I have noticed a half dozen or more ARFs, advertised chiefly for their durability, in just the last year or two. Many of these are very

basic, and not at all scale appearing, but they are damage resistant. They sell, so crash survival must be as important to many other modelers as it is to me.

Most of the commercial RC race car bodies are molded polycarbonate. That fact illustrates the durability of this plastic. I wouldn't be surprised to see one or more scale or nice-looking non-scale ARFs come out before long, that are mostly injection molded or thermoformed polycarbonate. I hope companies don't decide to keep polycarbonate model airplanes off the market because such models would be so rugged they would eliminate much of the repeat business.

I'm sure some of the ARF manufacturers are thinking about polycarbonate, and others may start experimenting with it as a result of these discussions, but my chief interest is with home scratch designer/builders. Join me in trying to innovate better model airplane construction processes and materials. The manufacturers will copy us rapidly enough if we show them something worth copying.

LOG BOOKS

In the March 1990 issue this writer described his own system of keeping rather extensive log books in which are recorded not only his model flights, but pilot errors, design problems, engine anomalies, electronic failures, etc. In other words, I keep permanent notes on my modeling. I refer to earlier volumes of my log books frequently, and they have proven to be very useful in my continuing efforts to become a better model designer, builder and flier.

Merv Buckmaster, of Victoria, Australia, wrote to second the advantages of keeping good modeling logs. His photo shows Merv's very neat collection of annual journals covering his modeling work. In addition to these journals, he keeps a separate log book on each of his models. My log books are chronological and each volume will contain records on the several models I am flying during the period covered by that volume. My "log books" correspond rather closely to Merv's "journals." Write them and use them, whatever you call them.

Merv Buckmaster is a retired scientist who

is now the editor of Australia's *Airborne* magazine.

PARTING WORDS

"An expert's guess is liable to be just as good as anybody else's." -Will Rogers.

Francis Reynolds, 3802 127th Ave. N.E., Bellevue, WA 98005-1346. SASE please. (206) 885-2647. **MB**

FUNZONE *Continued from page 13*

fuselage edges around this area and sand smooth. Round remaining fuselage edges and sand smooth. CA firewall front in place, round edges and sand smooth. Drill firewall for motor mount, throttle cable and fuel lines.

Cut tail surfaces from light 3/16-inch balsa. CA elevator halves to spruce joiner. Taper elevator and rudder to trailing edges with razor plane. Round leading edges and tips of stabilizer and fin. Sand all tail surfaces smooth. CA stab and fin in place, taking special care to keep straight and square.

Remove hatch, cut servo mounts to fit from 1/8-inch ply, CA servo mounts in place and add 3/8-inch balsa triangle braces under ends. Cut switch mount from 1/16-inch ply and CA in place. Install elevator, rudder and throttle control cables.

I covered the fuselage, tail surfaces and ailerons with tissue and two coats of thinned Sig Lite-Coat clear dope. I covered the wing with translucent Micafilm, added MonoKote trim sheet, stick on decals and sprayed on two light coats of Black Baron clear epoxy finish.

Bend tail gear from 1/16-inch music wire and attach 3/4-inch tail wheel with soldered washers. Thread a washer and T.W. bracket onto top end then bend top end over where it will fit between rudder control horn screws. CA T.W. bracket in place. Attach elevator to stab with EZ hinges, then rudder to fin. Fit elevator and rudder control horns in place. Attach ailerons to wing with EZ hinges. Install servos and radio gear. Secure wheels to main gear with soldered washers and epoxy gear into L.G. mount. Attach motor mount to firewall and install engine. Install

continued on page 75

NEW PRODUCT UPDATE

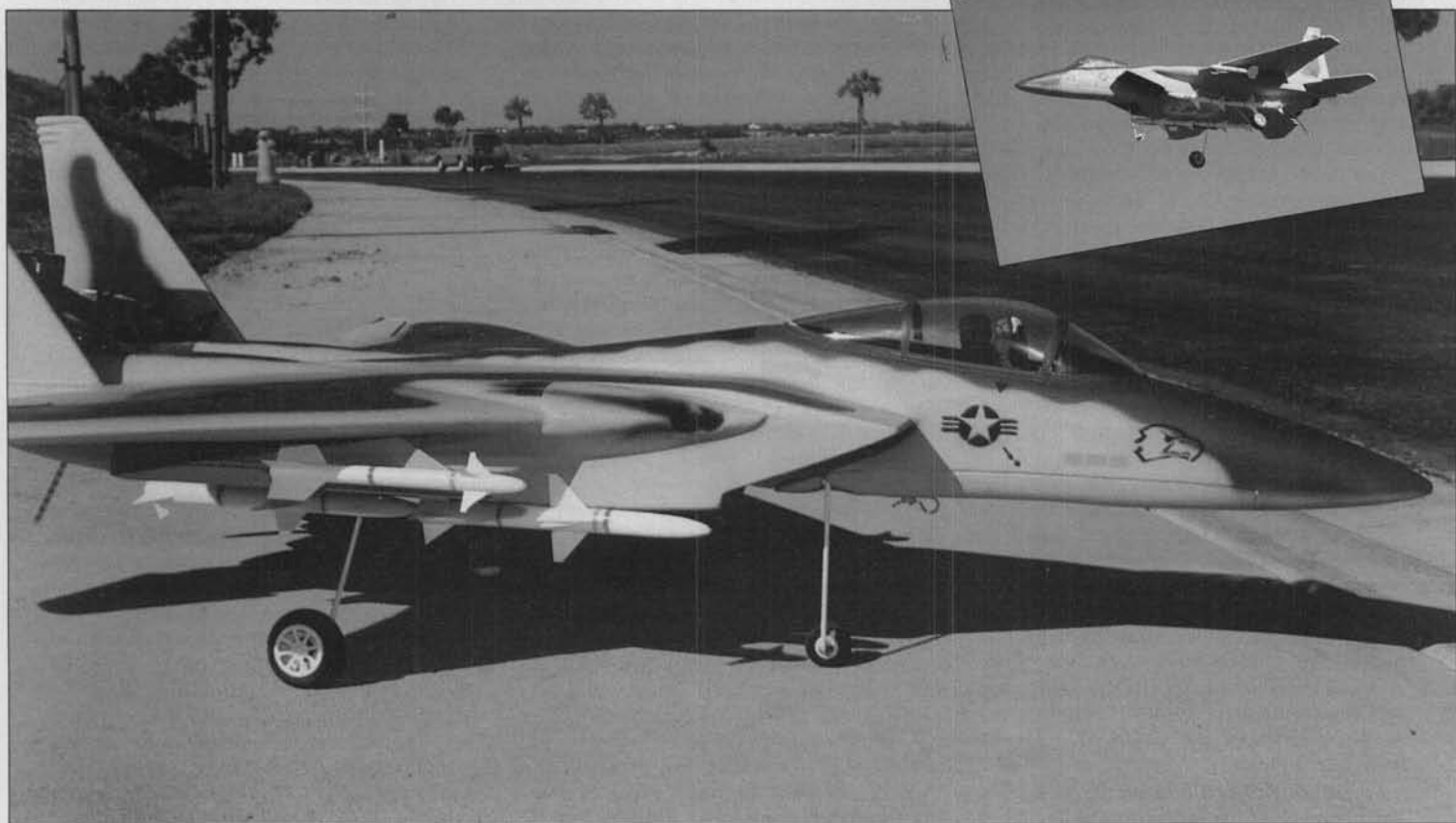
- Uni-Lock Universal Joint Starting System -- positive starter engagement at up to 15° angle without downforce or possibility of body damage. Adaptable to all popular models.
- Magna Fuel -- special heli blends with 12.5% or 30% nitro.
- Webra .50 Heli with X-Cell or Schluter Fan -- ABC - \$98.00; Ring - \$95.00.
- X-Cell .30-.60 Plastic Servo Tray with Push/Pull Collective -- *Coming in Spring*

miniature aircraft USA

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A LOOK AT THE COMBAT F-15 EAGLE



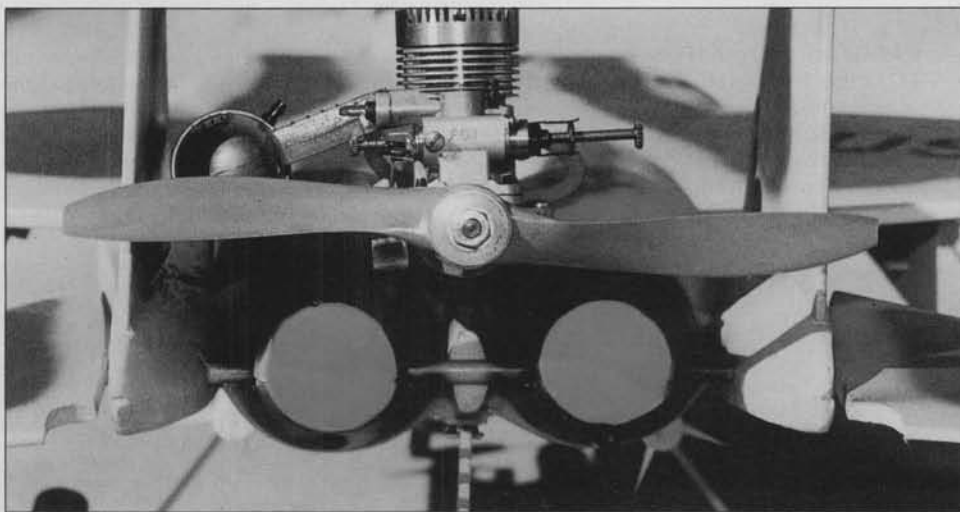
(Above) Notice the bristling armament and authentic appearance on this month's exciting subject as it sits on the flightline ready for action. (Insert) The F-15 Eagle in a sizzling low pass. Performance is spectacular.

It was seven in the morning and I was enjoying a leisurely breakfast. As usual, the southern California sun was shining brightly, but the whistling winds told me this would not be a good day for model flying. I had a 10 a.m. appointment with Byron Bruce of Combat Models Inc. to photograph some demonstration flights of their new ARF, the F-15 Eagle. It's not often I get a chance to check out a really high performance ARF, so I was feeling apprehensive because I expected Byron to call and postpone the flying session at any moment. By nine o'clock the sixty knot winds had subsided to thirty or forty knots, and Byron hadn't yet called to cancel, so I threw my camera in the car and drove south to the San Diego office of Combat Models.

Byron was waiting for me with a few test planes, and I told him he could postpone the flying if he wished, as the winds were still gusting pretty heavily. We stood there talking as formations of full size F-14s flew close over our heads, entering the landing pattern at nearby Miramar Naval Air Station, better known as "Fightertown U.S.A.," the home of Top Gun. After assessing the windy conditions, Byron decided to go ahead with the flight demonstration, so he and his staff loaded the planes and equipment into a couple of vehicles.

Combat Models has been around for some time, manufacturing warbird slope gliders out of injection molded foam, but the F-15 Eagle is their first excursion into powered RC models. The first impression I had when I

saw these models in their warpaint was that they were as realistic as any scale ducted fan airplane I had ever seen. I had to look twice before I realized that they were powered by tail-mounted pusher engines which blended in with the airplanes so well that they were hardly noticeable. I observed that the models were adorned with a full compliment of air to air missiles, bombs, and highly realistic fuel drop tanks. All of these were molded of the same four-pound density foam as the main airframe, and with a coat of paint they looked mean and businesslike. All of these molded parts come packed in a box which really deserves mention, as it is shaped to roughly resemble the model inside. Included with the kit is a lot of the necessary hardware, but the builder will have to supply a



Rear view shows how neatly the Fox .50 is installed. This simple pusher configuration is an easy way to prepare for flying complex ducted fan models.



Erik Hogan, member of the design team, and Byron Bruce, president of Combat Models Inc., display three of their F-15 in different color schemes.

Sullivan OV-8 fuel tank (8 oz.), wheels, wheel collars, and a 48-inch nylon pushrod. Along with the kit come a couple of foam jet jockeys which can be painted to look absolutely scale. And speaking of scale, this F-15 Eagle is not stand-off scale, or semi-scale, or near scale, but absolutely full scale in every respect, except for the externally mounted engine. Those who are purists in this regard can put this model together with the satisfaction of knowing that they will end up with a scale RC model which qualifies for entry in just about any scale contest. Of course, the engine hanging out in the wind will no doubt lose a few points, but in the hands of a capable pilot, placing in a scale contest is a definite possibility.

One of the goodies I fished out of the box

was a videotape, and it is difficult to find the words to describe its outstanding quality. This professionally-made masterpiece is practically a "must see" for anyone who loves flying. It opens with a beautiful series of flights by full-scale F-15s doing graceful and breathtaking maneuvers. The video then shifts to the Combat Models F-15, and clearly demonstrates the assembly of the model, right down to applying the finish. Actually, finishing the model couldn't be easier. First, the surfaces are gently sanded, then covered with lightweight spackle, either Patch-N-Paint or Model Magic. This is again lightly sanded and the paint finish is applied. Any foam compatible paint is fine, even water based latex housepaint. The kit comes with a set of stencils, which must first be cut out

with a sharp knife, and are then applied to the finished model. A light coat of paint is then sprayed over the stencil, producing a nice touch of detail.

One advantage of this model is that only three servos are required (aileron, elevator, and throttle), so really complex radios are not necessary. Nosewheel steering is attained by linkage of the nosewheel to the aileron servo, and this setup works quite well. Another advantage of this and other models based on foam construction is the great ease of repair, and most flying breakages can be fixed in practically no time at the flying field with a little five-minute epoxy.

The rest of the video is concerned with flying the F-15 model, and Byron Bruce, along with Erik Hogan, who is a member of

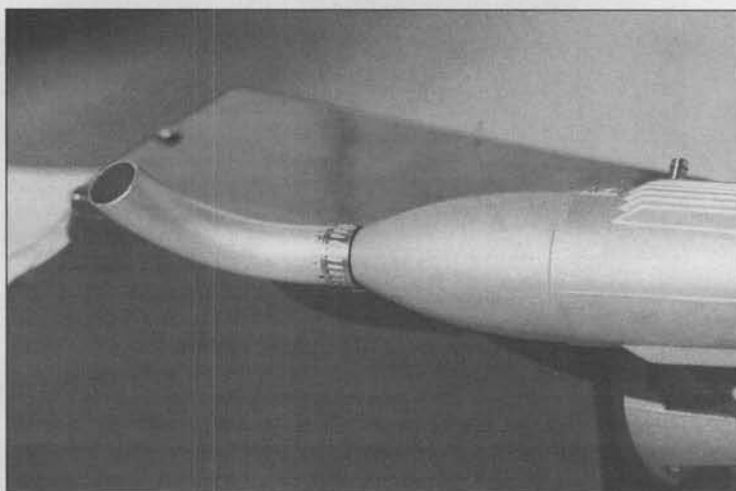
the Combat Models design team, put on a flying show which keeps your eyes glued to the screen. Not only are the flight demonstrations fascinating to watch, but a lot of useful flying tips are included; with special emphasis on how to handle a flame-out landing. In such landings the required re-

told me that they used Powermaster with 12 1/2, nitro exclusively. This answer didn't surprise me a bit, as I am thoroughly sold on this brand of fuel. I've been using it for years, and so have all my pattern and sport flying buddies. I use Powermaster 5% in my two-stroke engines, and in my four-cycle engines

rus, signaling they were ready for flight, and from the moment the F-15 models left the ground I was so fascinated that I almost forgot to take my flight photos. The speed of the models was somewhat unexpected, as they really hauled out, doing rolls that were so quick and tight you couldn't count them.



Twelve-volt field charger from McDaniel RC, Inc., means never having a dead NI-STARTER again. It installs easily in any field box.



MACS Products new aluminum exhaust diverter is a sure method of keeping goo off your models. Comes in assorted diameters.

sponse is similar to that used with most aircraft, i.e. to drop the nose to maintain flying speed, but with delta wing airplanes it is even more critical, and the tape clearly demonstrates this. One of the more spectacular maneuvers shown is called a "tail-stand" and consists of hanging the model almost vertically on its nose. Byron and the other members of the Combat Models squadron also put on a formation flying show with three airplanes performing a synchronized routine. The flying is accompanied by a beautiful soundtrack, resulting in a model aviation video which would be a welcome addition to any tape library. Actually, the tape is almost worth the cost of the kit, but we'll get to that a bit of information later on.

Byron and his staff have experimented a great deal with engines used in this pusher configuration, and presently they are exclusively using the Fox 50 RC powerplant. They have arranged with the Fox factory to provide these engines with reverse crankshafts, and Combat Models stocks a supply of these specially modified little screamers which they sell for \$99.95, plus \$2.95 for shipping and handling. They particularly like this engine not only because of its brute power, but because it is so light in weight. So far, the best prop found for this engine setup is the APC 10x7, mounted backwards, of course. The factory demo models had Perry pumps mounted on the engines, but the F-15 Eagle will fly quite well on an unpumped Fox .50. Combat Models is experimenting with mounting a larger 10 oz. tank farther forward over the C.G., but in this case a pump equipped engine will probably be mandatory.

I asked what kind of fuel the Combat Models people were recommending for use with the Fox engine, and they unhesitatingly

I always run Powermaster 15% four-stroke fuel. Years ago I ran other so-called quality fuels containing only castor oil lubricant, but couldn't put up with the gummy, burned-on residue which made my engines look like rejects from a swap meet. I then tried a fuel using only a top grade of synthetic oil, and ran into overheating problems and damaged engines. When I finally discovered Powermaster, which is an ideal blend of synthetic and castor oils, my problems were solved. Now my top end power is strong and steady, and my engines idle down to a whisper. So I thoroughly understand why Combat Models uses Powermaster fuels exclusively.

As we drove to the Combat Models' "secret" flying field, actually a deserted paved street in a light industrial area, I asked Byron what kind of expertise would be required to fly the Combat Models F-15 Eagle. He felt that anyone with a decent intermediate level of experience would be able to handle it easily. He said that if you can fly a Sig Kougou you should be able to fly this model. The F-15 does fly faster, so caution should be used until you get to know the plane and its responses. You have to know how to use the proper application of power and be familiar with the manner in which the nose is kept up on landings. Byron said that this plane can fly at 3/4 throttle and still keep the speed down to only 15 miles an hour by flying at an exaggerated angle of attack.

When we arrived at the flying site, the wind was still gusting to 30 knots on a constantly changing heading. The decision to commence flying was made, and while the three pilots prepared their airplanes, I readied my camera equipment and went about taking some static ground shots. Soon the engines were humming loudly in cho-

I can't think of many models which could have flown so well in such a turbulent sky, and it is a tribute to their clean design and close adherence to the lines of the original aircraft which contributed to their excellent wind penetration capability. The live demonstration was inspiring, and what appealed to me most was the scale manner in which the models were brought in to land, with the nose pointed up as the airplanes mused down toward contact with the runway.

Byron said that in an ideal landing, the final approach should be made with a five to ten degree nose high attitude. When on final, feeding in throttle will extend the approach, and decreasing throttle will increase the rate of descent. Once the mains contact the ground, the nose will gently settle. As the nose wheel touches, a little down elevator is added to keep the nose wheel on the ground as the landing rollout continues.

During the landing the plane may appear to be in a stall configuration, but it is actually musing in under full control. Anytime the angle of attack appears too great, adding throttle will bring the airplane to a more level attitude.

When the morning's flying was complete, I was an enthusiastic convert to this high-tech kind of airplane, and I determined then and there that I would have one for my very own. It occurred to me that for an RC flier about to go into ducted fan flying, the Combat Models F-15 Eagle would provide training for the needed flight skills to ease the transition from conventional airplanes. I have no doubt that anyone who spends enough stick time on this model will be quite comfortable flying a ducted fan. Besides, the cost is minimal, the time and effort required for assembly is hardly worth mention, and the

pleasure derived from flying this bird is almost sinful. The F-15 Eagle sells for \$73.95, plus \$6.95 S&H. A replacement kit (less hardware) sells for \$50.00, and both may be ordered from Combat Models Inc., Fightertown U.S.A., 8525 Arjons Dr., Suite K, Miramar, CA 92126. For information on

have used various systems to divert exhaust gases, but most are usually too flimsy, subject to heat damage, or just plain fall off the muffler in flight. The MACS diverter is made of tough aluminum and will never come off. It is available in various sizes to fit any muffler, tuned pipe, or exhaust system, and

gotten into the habit of putting my NI-STARTER[®] on charge when I leave for the flying field, and when I get there I'm all charged up and ready to go (in more ways than one). My flying buddies love it because they can charge up their pooped out batteries on my field charger in bust a few minutes, and



A closeup view of the cockpit shows a pilot figure at the controls. All markings are produced from a stencil supplied in the kit.



Factory cutaway demonstrates simple three-channel radio installation in forward area of fuselage.

their products, call them at (619) 536-9922. **PRODUCTS IN USE**

From time to time I have the opportunity to use new products aimed at the RC market, and when I find some that are particularly useful and innovative, I try to give my readers a full report. Often, the best new products are the simplest ones, and the first one I would like to tell you about comes from MACS Products, the leader in the field of exhaust manifolds and tuned pipe systems. One of the less complex items they manufacture is an aluminum exhaust diverter which is attached to the end of a muffler by means of an adjustable clamp. Until now I

I recommend it without reservation. For additional information, contact MACS Products, 7935 Carlton Road, Sacramento, CA 95826; (916) 456-7414.

The next product comes from McDaniel RC, Inc., the folks who brought us the indispensable NI-STARTER[®], found in almost every well-equipped RC field box today. Their latest innovation is a 12-volt field charger which is easily installed in a flight box and is attached directly to a 12-volt starter battery. By placing an almost discharged NI-STARTER[®] (or any other copycat product) in the charger socket, a full charge can be achieved in an hour or two. I've

while I'm flying, my NI-STARTER[®] is plugged in getting a steady trickle charge. The model I'm using is the #130, and you can get one from your local dealer, or contact McDaniel RC, Inc., 1654 Crofton Blvd. Suite #4, Crofton, MD 21114 (telephone 301-721-6306).

Now it's time to get back to answering all those letters from you readers with all those questions about ARFs. As usual, send your questions and comments to me at 2267 Alta Vista Drive, Vista, CA 92084, and please don't forget the SASE. You can always phone me at (619) 726-6636, or drop me a FAX at (619) 726-6907. **MB**



CURSOR - \$175

Wing Span: 65" Weight: 7.5-8.5 Lb.
Wing Area: 812" Engine: .61



LA-1 - \$175

Wing Span: 66" Weight: 7.5-8.5 Lb.
Wing Area: 800" Engine: .61

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SUMMIT III - \$195

Wing Span: 64.5" Weight: 7.5-8.5 Lb.
Wing Area: 790" Engine: .61



CONQUEST 120 - \$225

Wing Span: 70" Weight: 8.5-9.0 Lb.
Wing Area: 970" Engine: 1.20



FRESH-AIRE - \$225

Wing Span: 65" Weight: 8.5-9.0 Lb.
Wing Area: 860" Engine: 1.20

SCALE IS FOR FUN

Scale as defined in The Merriam-Webster Dictionary: "The size of a sample (as a model) in proportion to the size of the actual thing."

As the title of this column implies, all subject matter pertains to scale model aircraft regardless of the size as long as it is radio controlled. Hopefully, the column will contain information of interest for all scale buffs.

I have no axe to grind nor am I crusader. I simply enjoy building and flying scale RC models and there are literally thousands of you who have the same interests.

I get a kick out of competing. However, it appears as though the vast majority of scale modelers are not the least bit interested in formal competition and apparently no

amount of rule changing is going to change this. A high percentage of scale contests have few entrants. Yet, watch the scale modelers come out of the woodwork when a scale model fly-in or "un-contest" get-together is held. This type of gathering allows the modeler to show off his scale bird, swap ideas, and fly if and when he feels like it. A prime example of this is the International Miniature Aircraft Association (IMAA). Their growth has been and is phenomenal, and the reason for this is it's un-contest flavor of their fly-ins. True, the IMAA is not strictly scale, but is for larger size airplanes scale or otherwise. However, the majority of models at these fly-ins are of the scale type. Here in Florida, there have been a few fly-ins that allowed scale entries of any size and



Simple but effective cockpit detailing of Stan's P-51's, built for go more than show. And from five feet away, who would know?

Three Byron P-51's built and flown by Stan Sibley, Visalia, California. More description in text.



were well attended. I saw some models that were museum quality and were being flown as if they were your everyday sport job. I believe that we will be seeing more of this type of fly-in. Not only do the participating and non-participating modellers receive a great amount of satisfaction, but the spectators are royally entertained as well.

The photos of three Byron P-51's were sent in by Stan Sibley of Visalia, CA. It took Stan approximately two years from the time he started construction to the first flights. The planes are finished with epoxy paint and are clear coated. The lettering and art work was done freehand by a local teenager. According to Stan, all three planes required the same amount of aileron and elevator trim changes and flew exactly the same. All I can say Stan, is that you can be credited with building consistency as well as having the intestinal fortitude to build three of these big birds simultaneously! The cockpit detailing is simple and effective. This was Stan's first attempt at building this type of model. Outstanding, and I'm sure we will be hearing more from Stan in the future.

Although Stan is an accomplished flier, not only fixed-wing but helicopters as well, he realized that the larger heavier wing loaded models handle differently. To prepare himself, he purchased a Byron "Pipe Dream," hung a big hairy old engine on it and proceeded to learn how to handle a

plane with heavier wing loading. Stan said it really paid off when it came to flying the P-51's. This is good advice, whether you are about to fly a giant scale or a smaller scale model. If your new scale model requires coordinated controls during flying, or the wing loading is heavier than what you are use to, practice on a sport type model first. If you screw up, these are easier to repair than your scale model.

There are many talented builders and innovators who are known only locally, yet are utilizing building techniques and new materials that they are willing to share and could possibly revolutionize a certain as-

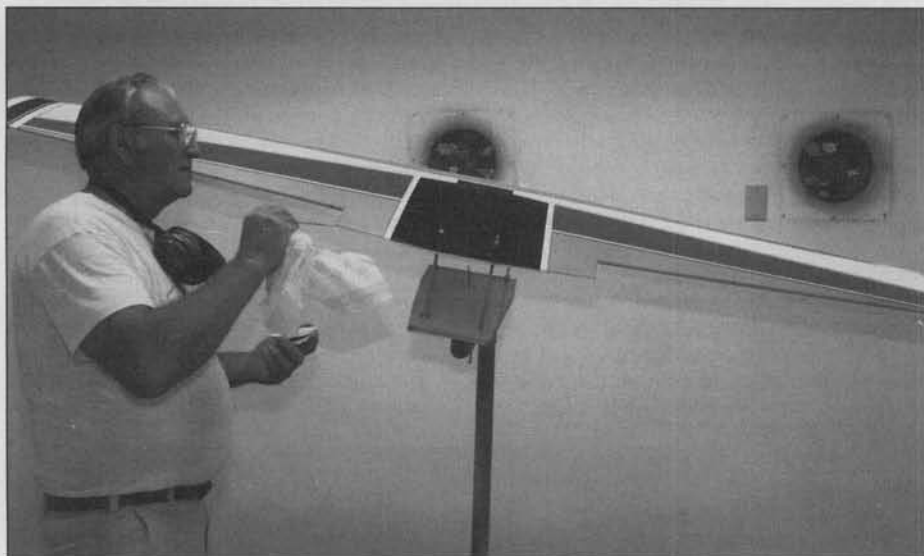
pect of our sport. I plan to visit some of these unsung masters and have them share a few of their techniques with you, complete with photos of course. If all goes as planned, I hope to include one of these interviews each month.

THIS MONTH'S MODELER

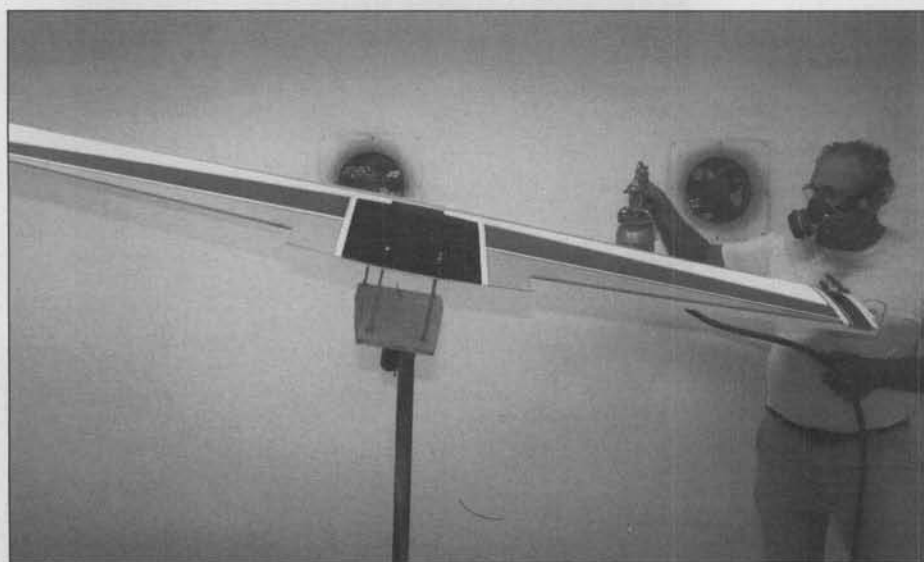
Meet Don MacGeorge. Don lives in central Florida and is well known for his fabulous paint jobs. Don has been modeling for many years and is an avid scale enthusiast. Not only is Don a fine builder, but an excellent flier as well. Don attributes his flying abilities to his experiences gained as a pylon racer. He says it sharpens the re-

(Right) Don with the Laser in front of his shop. His 6'-3" height gives you an idea of the model's size. (Below) A one-third scale Laser, built by Don MacGeorge, from central Florida. The smooth, glass-like finish is a give-away to Don's experiences gained from pylon racing.





Touching up a ding prior to application of final clear coat. Note wing holding fixture.



Don applies the clear coat. Note mask and exhaust fans in wall. Both are important pieces of equipment for spray painting.

flexes as well as forcing you to fly the model where you want it to go.

Don claims he has no special finishing secrets. The model to be painted has to be **PREPARED PROPERLY (!!!)**, i.e.; constructed as smoothly as possible and sanded to the smoothness of glass. The only secret is patience and lots of elbow grease.

INITIAL SANDING: Start with a course sandpaper for roughing out and then work your way up using finer sandpaper. Final sanding should be with #220 grit. Model can now be covered with your favorite material.

PRIMING: Any good epoxy primer fills well and sands easily. After the primer has cured, wet sand it all off using #360 wet-or-dry paper. Use a mixture of dish detergent and water and a sanding block with a sponge-like backing. Dampen the surface to be sanded. Do not "hose it" down with water, as doing this only makes it unnecessarily messy. Upon completion of sanding you will note that all low places (grain, etc.) have

been filled in. After wet sanding, wash the plane down with soap and water and let dry thoroughly.

FIRST BASE COAT: Before starting each coat, wash your hands thoroughly with soap and water to keep the natural oil in your hands from getting on the model surface. The first base coat should be the lightest predominate color. After paint dries, fill any nicks or dings using a filler that is compatible with your paint. Using wet or dry #600 paper, wet sand the base coat to be as smooth as possible. Don't be afraid of sanding through the base coat. Wash the plane with soapy water and let dry thoroughly.

SECOND BASE COAT: Apply a light second base coat. Remember: one pass of the gun equals one coat. If you go back over that pass area, you have put on another coat! Allow paint to properly cure. Cure time depends on paint used.

MASKING: Start out with the light colors first, then the darker colors. Using 1/4-inch wide 3M green plastic film line tape, mask

around the design outline. Cover the area not to be painted using a 1/4 or 3/4-inch wide masking tape and a commercial grade of paper available at auto paint stores. Apply the next color coat. Length of drying time before removing the masking tape depends on the paint used. If acrylic lacquer, allow it to dry six to eight hours before pulling tape for a clean edge. Repeat for rest of colors. After completing your color scheme, the edges caused by the masking tape can be hand rubbed out using #1000 wet-or-dry sandpaper and soapy water. Do not sand too heavily, as today's paints, especially acrylic lacquers, are such that the color may be removed.

CLEAR COAT: For that wet, shiny look, and a hard protective finish, a final finish called CLEAR COAT is applied. First, wash the model and your hands with soapy water. Allow model to dry thoroughly. The clear coat is a clear urethane finish. Be sure and use the type that is compatible with your finish. Also there are clear urethanes available that will turn yellow with age. Do not use these! Don uses Sherwin Williams brands and has not experienced any yellowing.

USE OF RETARDANTS: For acrylic lacquers, acrylic enamels and urethane clear, use of retardants is a must in most cases. Read and heed the directions on your paint containers. Use of retarders cause the paint to melt or "flow," resulting in a glassy finish. Too much retardant causes unsightly runs. The paint manufacturers instructions puts you in the ball park. The exact amount of retarder to use comes with experience.

Don favors acrylic lacquer, as any defects can be easily repaired prior to clear coating. Acrylic lacquer cures from the inside out. When the outside surface is cured, the entire thickness of the coat has cured. Acrylic enamel cures from the outside in. When the outside surface is dry, it is not necessarily dry all the way through.

There you have the Don MacGeorge basic finishing method. Here again it is a matter of patience, lots of work, and experience. The only way to get experience is to DO IT! Hopefully this method will help you get started in the right direction. The photos show Don clear coating a 1/3 scale Laser. Paints used are the new **KILLER COLORS** which are a bright fluorescent. Underside of plane is done in black and white checkerboard. Note fixture for holding wing. Use of fixtures eliminates unnecessary handling, which makes painting much easier and results in a ding-free finish.

If you have a pet method of building, finishing, aircraft setup, etc., or photos of a pet project and want to share them with the rest of us, send them in and I will try to include them in the column. The photos need to be crisp, i.e.; in focus, good contrast and resolution. Prints should be in color and at least 4x6 inches in size.

Send your material either to *Model Builder*, Attn.: "Strictly Scale," to be forwarded, or directly to me at 4223 New Haven Court, Port Orange, FL 32127.

See ya next month.

MB

control cables. Install fuel tank. The simple rudder activated bomb drop shown on the plan has proven to be 100% reliable. Just be sure to taper the notch in the nyrod tube back as shown so your bomb will slip away without jamming. Balance plane slightly nose down at spar. While the rudder and ailerons are not especially sensitive, the elevator is 1/8-inch to 3/16-inch up and the same amount down should be sufficient. Check all your controls for smoothness and correct direction, conduct your range test and you should be ready for your test flight.

The prototype has proven itself to be a dependable, low maintenance aircraft. It's the kind of model you can toss into the back of your car, zip out to the field and have a good time. Hope you enjoy yours. **MB**

RC SOARING Continued from page 18

gested retail is \$88.00, plus \$4.00 shipping, plus tax if you are a California resident

All prefab parts are available separately in case of need. And for further needed information, please contact Dick Dodd at Dickybird Models, P.O. Box J, Westminster, CA 92684-000J, (714) 775-4153.

DCU MODELS

Lots of new stuff here, too. Mark Hamill and Dan Danrich can be seen holding a pair of slope and thermal ships. The one on the left in Mark's hands is the new Wind Weasel. The model on the right in Dan's hands is the Wind Warrior.

The Wind Weasel is a polyhedral, V-tail model with carbon fiber arrow shaft tail boom and molded fiberglass pod which includes a molded-in pylon mount for the wings. The wings and stabs are built-up from balsa components, but a foam core wing is available as an option.

The span of the Wind Weasel is 60 inches, which places it at the top end of the AMA Class A definition for hand launchers. The airfoil of the standard balsa-ribbed wing is the good old Eppler 205 thickened to 1.2% to get rid of the 205's nasty low speed stalls. The optional foam core wing is the latest, top L/D producing Selig-Donovan SD7037. The kit will set you back only \$39.95, but the optional cores will run an extra \$20.00.

The Wind Warrior is a sleek, European-looking slope racer. It too has a molded fiberglass fuselage complete with removable nose cone, and foam cores (wing and stab, standard). The wing is 70 inches in span, and the wing area is a mere 315 square inches. Pre-cured epoxy fiberglass wing sheeting, and premolded F/G fin cap is also standard. Kit includes full hardware for aileron and elevator control. Price will be about \$149.00.

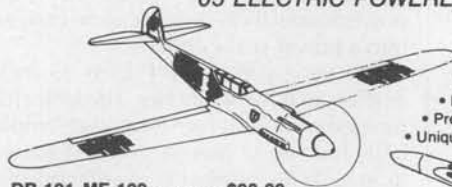
Although not really new to the show (it was there last year) the DCU F-14 is finally ready to go. This 50-incher has a flying weight of 32-36 ounces, features foam cores, fiberglass fuselage, and can hide a full-size radio inside. *continued*

TRICK SCALE

RC ARFS

Dickybird models

BATTLE OF BRITAIN WARBIIDS
05 ELECTRIC POWERED SAILPLANES



DB-101 ME-109.....\$98.00

- Span..... 60 inches
- Length..... 34 inches
- Wing Area..... 420 sq. inches
- Weight..... 44 oz. (Powered)
- 27 oz. (Glider)

3 Channel Radio Required for Aileron, Elevator and Motor Control. All Prefab Parts Available Separately.



DB-102 Spitfire.....\$98.00

- Featuring*
- Vacuum Plastic Body and Tail
 - Full Decal Set
 - Machine Cut Balsa Stab
 - Prefab Lite Ply and Balsa Fuse
 - Prefab Balsa Sheet Wings
 - Unique DickyBird Hi-lift Airfoil

CLASSIC GLIDERS OF THE 1930's
SLOPE SOARING OR HI-START LAUNCH



DB-103 Kirby Kite.....\$88.00

- Span..... 72 inches
- Length..... 31 inches
- Wing Area..... 390 sq. inches
- Weight..... 27 oz.
- 2 or 3 Channel Radio Required



DB-104 Grunau Baby.....\$88.00

- Featuring*
- Vacuum Plastic Body Pod
 - Prefab Lite Ply and Balsa Fuse
 - Prefab Balsa Sheet Wing
 - Optional Spoilers

SELF-RIGHTING SAILBOATS



DB-105 36-600 CAT.....\$138.00

- Length..... 36 inches
- Sail Area..... 600 sq. inches

DB-106 Formula 40 CAT.....\$148.00

- Length..... 39.4 inches (1 meter)
- Sail Area..... 720 sq. inches



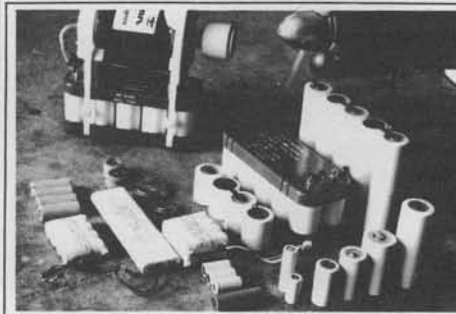
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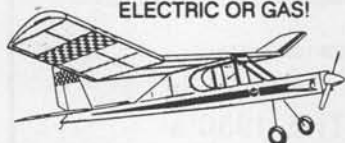
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Also available as separate items are the fiberglass fuselages for the Wind Weasel, Wind Warrior, and Wind Star. For any further information, you will have to call Mark directly at (714) 535-6969, 1556 S. Anaheim Blvd, Unit C, Anaheim, CA 92805.

COMBAT MODELS

Byron Bruce of Combat Models has available a really neat looking molded high density styrofoam F-15 Eagle. And although it was designed as a .40-.50 size pusher power model (boo-hiss), it can be converted into a power scale sloper.

The wingspan of the F-15 is 33 inches, and the length is 47 inches. The kit includes molded wings/fuselage (one piece), molded belly hatches (2 pieces), molded stabs (4), drop tanks (3), bombs (9), missiles (8), pilot's head with seat back (1 ea.), and misc. hardware, some of which relates to the power aspect of the model.

Contact Byron Bruce for any other details you might want: Combat Models, Inc., 8535 Arjons Dr., Suite R, Miramar, CA 92126.

CHEETAH MODELS

The Lynx made its debut at the IMS show this year. The Lynx is a fun-fly-type model for slope glider guiders. It is highly aerobatic and a real blast to fly, according to Larry and Bob Pettyjohn, co-owners of Cheetah Models, 14725 Bessemer Street, Unit B, Van Nuys, CA 91411, (818) 781-4544.

The Lynx is your basic foam core wing, balsa fuselage sport flyer. It has a span of 50 inches, an area of 388 squares, a length of 33 inches, a flying weight of 32 ounces, and a wing loading of 11.8 ounces per square foot. Complete hardware and kit cost only \$52.95 plus shipping and handling and tax if in Calif.

Also of note for people looking for the hard to find adhesive transfer tape for wing skin mounting . . . Cheetah Models has it. The one-inch variety comes in 60 yard lengths (enough to bond 7-1/2 planes' worth of wing skins). Cost is about \$12.50 per roll (call for exact price).

BOB MARTIN RC MODELS

Katie and Bob Martin are busy cranking out the Duralene fuselages of late, and that means the kits which require them are back in stock all over the place. Making its reap-

pearance after years (can it really be that long?) of being unavailable is the Katie II. But, for reasons which shall become obvious, maybe it should be called the Katie III!

The Katie II, which is an aileron trainer sailplane, has had a major series of improvements. First is in the Duralene(TM) formula itself. Duralene is now stiffer and stronger than before, and in the case of the new Katie II design, also one ounce lighter at 10 ounces.

So what's Duralene you ask? Well, it's a nearly indestructible white plastic that makes great fuselages for fliers who like to land on surfaces OTHER than nice, soft grass . . . surfaces like dirt roads and pavement. Duralene resists cracks, nicks, deep scratches and tears caused by rocks, dirt, sticks, and other hard objects which normally destroy balsa. It'll even take a pretty severe blow and simply bounce back.

The Katie II fuselage now comes molded in such a way that the mold parting line (where mold flashing is always present after the molding process) is in the center of a raised horizontal ridge. The flashing is much easier to remove along this ridge because it sticks out away from the right and left fuselage sides where it can easily be sanded or cut off. The end result is what looks like miniature molding strips on the sides of a car. These ridges also add additional strength to the fuselage.

Full size servo recesses have been added for easier elevator (and optional rudder) and aileron servo mounting. A "sorta scale" instrument panel has been added for looks. A new .060-inch thick, clear, snap-on canopy is now standard, which eliminates the need for canopy trays and the attendant CA fogged canopy plastics. It also eliminates the need for canopy latches or hold-down rubber bands. The tow hook area is now molded flat and recessed into the bottom of the fuselage for a neater, more secure tow hook.

Other features of the kit are foam core wing panels with balsa sheeting, flat bottom airfoil for easy training flights, machined balsa stab surfaces, and basic hardware. The span of the Katie II is 73 inches, its area is 550 square inches, and it requires a two- or more-channel radio.

OTHER FINE KITS AVAILABLE

Kit #	Description	Price
TM-1	Junkers Ju 52 24" Span, 3 Prop.	\$12.00
TM-2	CRDA CANT 2.1007 "Alcione" 24" Span, 3 Prop.	\$12.00
TM-3	AVRO 683 Lancaster 33.5" Span, 4 prop.	\$15.00

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See your local dealer for a Katie II, or call your favorite supplier for price and availability. Any other technical details can be obtained from Bob Martin Models: 1520-C Acoma Lane, Havasu City, AZ 86403, (602) 855-6900.

Before we leave the Martin booth, however, one more bit of news. That wonderful old Hobbie Hawk just keeps on living in spite of all odds for its demise. However, the original Hobbie molds and toolings have been sold again. This time to a Mr. Ron Ross of Ross Models, Inc. 708 Dermody Way, Sparks, NV 89431, (702) 358-7677.

Limited quantities of Hobbie Hawks are once again available as well as replacement parts. Send a self-addressed, stamped envelope to Ron and he will send you a photo copy of the new price list.

AMS IMPORTS

Arnold Wratschko at AMS Imports is always a dependable source for Austrian and German sailplane kits. Shown in his booth at this year's IMS was a rather large (110"/2.75m) Pilatus B-4 sailplane. Although not really "new" to the world of modeling, there are perhaps thousands out there who have never seen one before.

This Pilatus is equipped with the Eppler 374 airfoil which will allow it to fly aerobatic routines that'll blow your mind. It even comes with a metal bladed spoiler system already built into the wings at the factory so that this speedy sailplane can be landed

with greater accuracy. Of course, there is a molded fiberglass fuselage, stabs, and complete hardware to finish this beautiful T-tail model. If that's enough to get your scale juices flowing, give Arnie a call at (702) 786-7733, or write 1110 S. Wells Ave., Reno, Nevada 89502. **MB**

PLUG SPARKS *Cont. from page 31*

four-stroke (open rocker type), the model is an amazingly good flier. Trimmed in transparent yellow and metallic blue "MonoKote," the model is quite attractive despite its simple angular lines. Best part of all, the model does perform well!

Sweden

We simply cannot resist the photo sent by Sven-Olov Linden of Orebro, Sweden, who submits a shot taken at the Swedish O.T. Nats, of Sune Stark with his original 1936 design, "Tip Top IV." This is the actual 1936 model that has been reworked and recovered. Naturally, if it won back in 1936, it would win in 1990. At 71 years of age, this fellow Stark is still going strong. The name Stark means "strong" in Swedish. How appropriate!

Italy

Fernando Gale, 10 Via Marconi, Bovenno (NO) 28042, Italy, writes to say their SAM Chapter membership now stands at 250, with more being added every day.

The same old problems in SAM again crop up. There are now two factions in Italy; one that favors strong competition with demanding type rules, and the second, the large majority, that prefers leisurely flying. The quest for unusual, little-known and oldest designs appears to be their goal for fun.

To that end, Ferd sends in a photo of a MOVO M4 "Professor," a free flight glider built by Vito Santacesaria of Brindisi. This German glider is a faithful reproduction of the original.

Gale reports most encouraging news in that there are many youngsters among the Old Timers (like Gale) who like to put balsa bits together instead of assembling a prefabricated model right out of an attractively-colored box.

These lads have discovered what SAM is all about; the creation of Old Timers starting from the very beginning with various sizes of balsa strips and sheets. A modeler can take a great deal of pride from his own creation and at the same time admire others who do the same. It's a great fraternity!

ALDRICH MODELS

We have publicized the new company, "Aldrich Models," that George Aldrich has started, and now we have quite a bit of information on just exactly what is being done. His list ranges from chrome plating and fitting of cylinders at \$40.00 to rework of ignition engines (including heat treat and test) for \$75.00. *continued*

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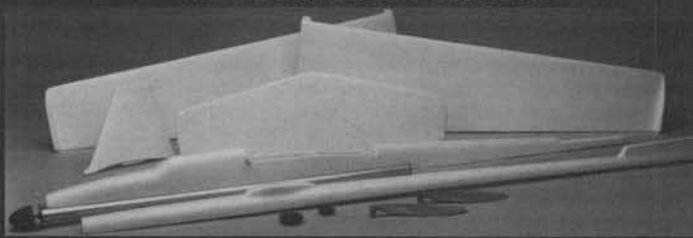
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Photo shows components for RB-1 King Condor.

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For those who are looking for rework of their modern stunt and racing engines, George also provides chrome work, heat treating, and rework of engines up to 65 cu.in. One of the more expensive is the Dooling 61 with a complete rework for \$125.00. Best idea is to write George Aldrich at 12822 Tarrytown, San Antonio, TX 78233.

George hits the nail on the head in his write up of what he is offering in service. Here is a direct quote:

"In addition to full chrome and re-chrome service is the special heat treating and fitting of cast iron piston/steel cylinder engines. This is a broadening of a technique worked out on the Rossi .15 back in the '70s, and

many of these engines are still running strong today.

"What we can offer now is the ability to restore worn cylinder assemblies with cast iron pistons to at least as good as new compression. Additional benefits include longer life due to the piston hardening, and the salvaging of some cylinders that have become unusable. Not only can this process be applied to out-of-production engines, but to new or used engines for everything from free flight, to control line, and RC. In conjunction with this, cylinder port modification will be offered to give a steadier engine run for aerobatic events, either unpiped or piped.

"With so many of the engines in use today coming from outside the U.S., availability of parts becomes a major problem. Shamrock Competition Imports has always endeavored to keep a full line of parts for any engine they distribute. For this reason we can offer parts availability, as good as any, for the fine OPS and YS engines, as well as K&B. My local distributor carries the entire Fox line of parts. And in some cases we will offer special piston/cylinder assemblies and other custom parts on a special order basis.

"Back in the early 1970's, the basic process for the ABC setup was developed in my shop. Needless to say, these techniques have not been lost and we have developed some new and better things along the way. These past few years my modeling interests have centered on my childhood beginnings, i.e. Old Timer, free flight, and C/L Stunt, with a pure ignition engine running on the old 'gas 'n oil' fuel. Over the past six months I've spent quite a bit of time testing, retrofitting, and retesting various ignition engines like the Super Cyclone, Anderson Spitfire, Orwick, O&R, etc. While leaving these engines in their original plan form, the increased performance from the retro-fitting has been more than gratifying. Engines with blind cylinders (Bantam, O&R, O.K., etc.) are much harder to work on. Ohlsson & Rice engines, because of the cylinder being permanently attached to the case, are the most difficult. Under development now is a method of restoring the rod, wrist pin, and piston fit, so that many of these engines can

be put in use."

Now, before all you guys rush to the telephone to beat the crowd, George would like to emphasize no calls after 10 p.m. Central Standard Time. Other than that, George welcomes all calls at (512) 656-2021.

MORE NOSTALGIA

We are still pushing Nostalgia RC, and more and more West Coast clubs are scheduling Nostalgia events. Of course, the NCFCC, with Bill Bowen as RC Contest Director, is putting on no less than seven contests in 1991. This formidable schedule should bring out the modeler who says this is a one-time type event.

In addition to the above, Vic Cunningham and son are promoting R.O.W. events at the US Free Flight Championships at Lost Hills, California. Vic has informed me there will be a 24x24 ft. area available.

In that same thought, we again feature an old photo taken by the late Dick Everett, showing National Champion Bob Holland launching his "Hybrid" design at Lake Elsinore, a favorite model seaplane site. The model somewhat resembles an Ehling Phoenix, but looks more like a Civy Boy layout when viewed from the top. As a side plug, Pond has the plans of the Holland Hybrid, as received from Gene Wallock several years back.

1946

Remember when control line flying became the craze? When Ernie Babcock and his son, Ernie Jr., started winning fabulous prizes in control line speed, this aroused the attention of modelers. What really brought them to bolt upright was when the Babcocks won a full-scale Taylor Cub. Wow!

Everyone (including this writer) immediately jumped on the bandwagon for some of those great prizes. No one was immune from the attraction as can be seen in the photo of Dick Korda with a control line model in 1941.

Closer inspection will reveal the model is actually the F/F Cleveland "Champion" as designed by Korda. He had removed the pylon and chopped the wings down. This was done by most modelers in those days; i.e. converting old F/F models and making

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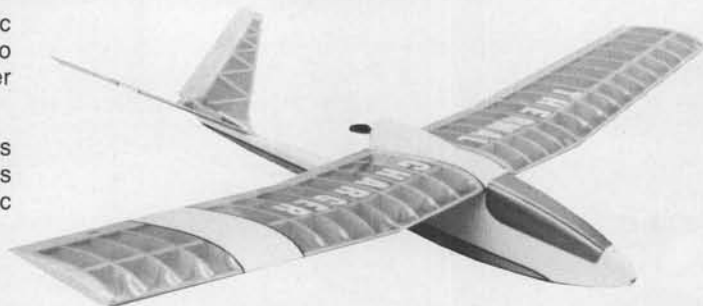
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what were popularly called "goats." Many of these conversions served as trainers and designs to start flying speed.

CHICOPEE REVISITED

At the last SAM Championships held over the Fourth of July weekend at Westover AFB, Chicopee, Massachusetts, Harold Johnson took a most interesting photo. At first glance, the model, built by Mal MacLean of Com-mack, New York, appears to be a run-of-the-mill Comet Zipper. On closer inspection, however, the model turns out to be a Czech design known as the "Meteor." It was one of the plans collected from Dave Baker during my last visit to England. To round out the confusion, the model is powered by an Italian Owat diesel, which was the forerunner of the Super Tigre line of engines.

Mal is our sort of guy; he builds off-beat designs and uses little-known engines. There should be more of this, as there are other things in "them thar mountains" besides Lanzo Bombers.

This writer also received a flock of Czech plans that Don Bekins brought back with him. The majority are Nostalgia types as they miss the Old Timer deadline of 1943. Nevertheless, we gottum!

While on the subject of the SAM Champs, we received a very nice shot of Dave Stott winding his Earl Stahl "Hurricane." This low-wing design was featured in this column along with comments that Jim Adams and other SCAMPS members flew them in a

mass launch.

Most surprising are the good flying characteristics of this model. Remember that when flying low-wings with the line of thrust over the wing, downthrust is generally not needed, but torque has a more pronounced effect. This writer has found anywhere up to 1/8-inch of right thrust is generally necessary.

NCCFC CAPERS

With Bill Bowen running no less than seven O.T. contests a year, it is no great surprise to run into some different models and action.

One of the photos shows what we mean: Brad Allen showed up with a little-seen Bill Atwood design, the "Flying Phantom Jr." as produced by American Balsa Wood Products. This model has been faithfully reproduced to the point of a Model F Baby Cyclone, with the original metal mount.

This model was originally designed for quick construction as can be seen by the sheet balsa tails. Wing tips were simplicity themselves, being made out of 1/8-inch dural wire bent to shape. Not a bad looking model for a "quickie."

O.T. HYDRO

It is about that time of the year when SAM 51 stages its annual meet which also includes hydro flying in the form of a Texaco Event. The accompanying photo was taken at the Woodland Model Airport in California, which also boasts a good-sized lake to

accommodate hydro flying. Seen in the shot is Howard Osegueda cranking up his Ray Heit "Scram." Two other SAM 00 members, Dale Bowers (1) and Dave Steinel offer helpful advice.

Later photos show the model successfully taxiing, flying, and landing. Landing was a flip-over. You can't win 'em all!

ELECTRIC POWER

There are some modelers who feel electric power has no place in Old Timers, but the inescapable fact remains that Leisure Electronics has marketed two very successful kits, the Playboy and Lanzo Bomber. These have had an impact on O.T. contests to the point where at least two electric events are held at each West Coast annual meet.

SAM 41 newsletter editor, Jim Alaback, sent in the photo showing Larry Oliver holding a 1938 Pacific Ace, powered by an Astro Cobalt 05 motor. This shot was taken at the SAM 41 Aeroneers contest held at Alpine, California.

THE WRAP UP

We should title this section, "Crash!" Joe Beshar sends in a shot taken at the September 9, 1990 SAM 15 meet at Bridgewater, New Jersey, "SPOT" contest (SPOT: Society for Preservation of Old Timers).

The model was a Buzzard Bombshell, built by Frank Lashek of Farmingdale, New Jersey. This 15-year-old model was powered by a K&B 35. According to Joe, this is



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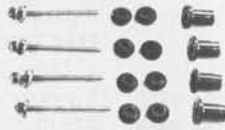
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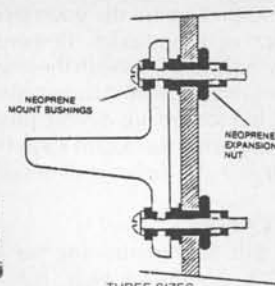
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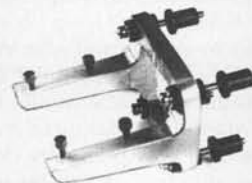
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what happens to an O.T. RC model when the switch is not turned on. The model hit so hard, the engine can be seen embedded in the chain link fence!

Welcome to the "Switch-Off" Club, Frank. This writer is a charter member! (Frank should be remembered by modelers dating back to Air Trails and American Modeler days. He was a frequent contributor of model construction articles, including the "Bunker Boat," as well as control line and RC scale designs. - wcn).

MB

HANNAN'S Continued from page 34

model plans at \$5 postpaid in the U.S.A. Foreign readers should add an additional \$2 postage. Order from: Upper City Lab, Box 150, Pittsfield, NH 03263.

ANYONE FOR GIANT SCALE?

At the opposite end of the size range interest, Colonel John deVries and Dick Phillips, both editors of model magazine columns, have recently released Volume 2 of *ViP's Directory of Giant Scale Plan* Featured are reviews and evaluations of fifty different model construction drawings based upon the combined experience of the compilers, who explain:

"Obviously we have not been able to build a model from every plan we've covered here. Such a task would be a life's work and leave little time for anything else."

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We particularly appreciated this conclusion:

"Anyone who has ever designed a plan and built from it knows the many hours of painstaking work which go into such a project. Without the designers, modeling would not be as much fun nor the challenge it is." Amen to that!

Giant Scale Plans, Volume 2 is softbound, illustrated with photos, has 114 pages, and may be ordered from: ViP Publishers, Inc., Box 16103, Colorado Springs, CO 80935, for \$14.95 plus \$2 postage and handling.

SIGN-OFF

From the quotations sprinkled throughout Walter J. Hamilton's book, *A Touch of Glass*, this important thought: "Time cannot be expanded, accumulated, mortgaged, hastened, or retarded." Don't just sit there, build something!

MB

KOYOSHO Continued from page 39

mAH battery pack. The JR transmitter case has a very comfortable feel in the palms. The JR 130 gyro (around \$80) is a perfect match for this radio. The Airtronics 6-channel Vanguard FM (about \$250) and Vanguard PCM 6H (about \$300) are also excellent



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helicopter radios for beginners. They come with four servos. But when you buy the Airtronics SG-X gyro (\$80), the gyro includes a special servo. The Vanguard 6H radio that we reviewed a year ago has worked very reliably (May 1990 *Model Builder*). The Futaba 5NLH is also a proven beginner helicopter radio. It comes with four servos. Thus, you do need to buy a fifth servo separately. The Futaba G-154 gyro (\$80) would be a good choice for the 5NLH. In general, for beginners, I recommend purchasing the same brand of gyro as the radio. Beside these three popular brands of radios, there are three inexpensive helicopter radio systems just introduced in 1991; Hi-Tech 7H, Focus 5H, and Kyosho 6H.

It is very easy to set up the collective pitch travel on the Concept. Again, move the throttle control stick to the center. There should also be a pitch trim knob, or a pitch trim tab on your helicopter radio. You should always set it in the middle. This knob is used for fine tuning the main rotor rpm in flight to match your engine power. Now, the pitch servo arm should be in the center. Connect the collective pushrod to the second or third hole on the servo arm. Adjust the length of the collective pitch pushrod so the collective control bellcrank is about in the center of its range of travel. With the throttle stick in the center, use the paper pitch gauge that comes with the Concept to check the blade pitch angle. The main rotor blade pitch should read 6 degrees. Check both blades. If they aren't the same, then adjust the length of the two pushrods that go to the main rotor blade grip. It is important that both blades have the same angle. Remember, when you are setting up the blade pitch, the swashplate must be perfectly level.

Now, pull the throttle stick all the way back. Again, using the paper pitch gauge, the blade pitch should be zero degrees. If they are not, then adjust the Lo end pitch curve trim pot on your heli radio transmitter. Turn the pot until blade pitch is zero degrees. Make sure none of the pushrods or bellcranks are binding, bottoming out, or hitting the sideframe. Next, move the throttle stick all the way up (forward). Adjust the Hi end pitch curve trim pot until the pitch gauge indicates ten degrees. These setup guidelines are for beginners. In fact, the above guidelines for setting up are applicable for the Concept, as well as the Shuttle ZX, and Enforcer. They all use six-degree pitch for hover, zero degrees for low end, and ten degrees at full throttle. Setting the low end at zero degrees prevents the model from descending too rapidly, which may cause the model to impact the ground and cause boom strike.

Once you can hover comfortably, don't touch the hover and top end collective pitch setting, but you can reduce the low end pitch to minus two degrees, so the model can descend quicker. This is necessary when you start to learn forward flight. Without any negative pitch, the model would float and become difficult to bring down. About minus four degrees is needed for doing autorota-

tions with the Concept. The Concept likes to float down too slowly in autorotation. Three or four degrees of negative pitch are needed to prevent the model from gliding too far. For inverted flight, minus seven degrees is necessary for inverted hover and shallow inverted climb out. But minus ten degrees would be better. Since only SX has plus and minus tens degree of collective travel, we recommend the SX for advanced fliers.

All three 30-size models fly superbly inverted. For readers who are interested in getting started in inverted flight, I suggest you learn to fly inverted without using the invert switch. In the long run, knowing how to fly inverted without the invert switch will improve all of your aerobatic maneuvers. For example, knowing how to fly inverted without a switch will improve your slow roll. It also permits you to constantly flip your model rightside up or upside down without having to toggle any invert switch. Then, you will be really using the full flying envelope of which these model helicopters are capable. The pitch curve and throttle curve for using hi-idle to do switchless inverted flight were explained last month.

Finally, on most of these helicopter radios, there is an "ATS" function. It is sometimes called tail rotor compensation. This function simply automatically increases the tail rotor pitch slightly as you increase the throttle above half stick. And, it reduces the tail rotor pitch slightly as throttle is brought below half stick. The reason this is needed is because increasing engine power and main rotor pitch would increase the torque reaction exerted by the main rotor on the fuselage. Thus, more tail rotor pitch is needed to counteract this torque. Ideally, if ATS is set properly, you can punch full power from hover, and the model will leap vertically like a rocket without ever twitching its nose. As beginners should not hop more than one or two inches off the ground on the first few tanks of gas, ATS can be difficult to set properly. ATS should be set by someone who knows how to fly. For now, I suggest you first turn the ATS knob to the middle of its range. For example, if the range scale says 0 to 10, then set it to 5. Some radios have two ATS knobs; "up" and "down" knobs. Set both to the middle of their range. There may also be a switch that needs to be set for the direction that the model helicopter main rotor blades spin. For the Concept and all the US and Japanese made models, set the switch to "R," which means the rotor rotates to the right, or clockwise when looking from the top. Finally, beginners should always buy a set of training skids from the hobby shop. Training skids help prevent tipovers.

The stock foam blades that come with the kit are perfect for beginners, or doing crazy hot doggings, because they can take more abuse than wood blades. Foam blades just dent or crack on the skin when the model flips over or dorks into the ground. Wood blades will split immediately. These foam blades have a fiberglass spar inside that's almost indestructible.

The blade bolt should not be tightened all



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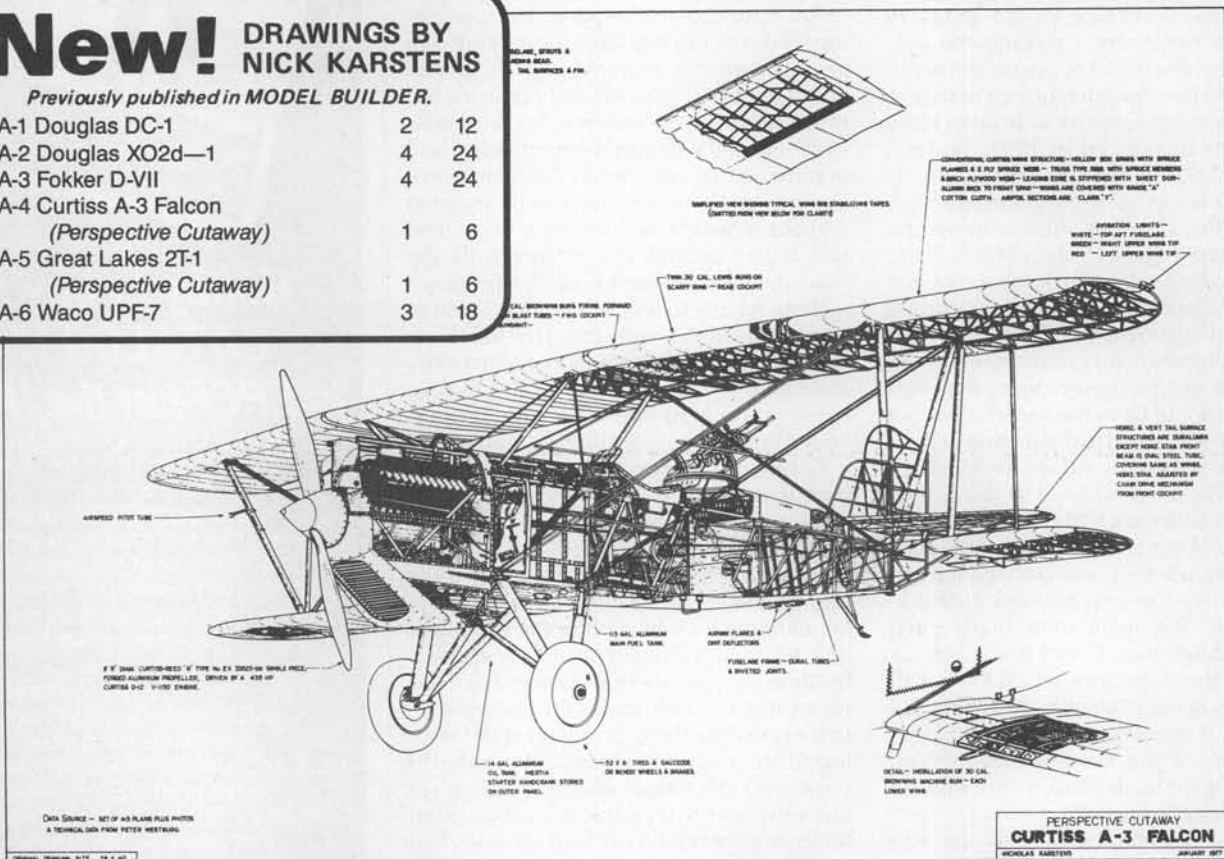
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the way. This will cause the Concept to oscillate fore and aft in hover. The blade bolt should not be too loose either; this will tend to cause boom strike on landing because the blades would fold back too easily and strike the tail boom. The main blade should fit in the blade grip with fairly good friction, but you can still fold it back with a light push.

Before we end this review, let's go over some new accessories that are available for the Concept. All kits now come with new Pro II style foam blades. Kyosho now has fiberglass 30-size blades with kevlar reinforcement. There is a limited edition carbon graphite tail boom. A hardened steel pinion gear is available. The stock aluminum pinion gear will wear and become sharp after about 200 flights, which will then cause loose gear mesh. The fiber lining for the clutch is now available in a pack of three (KYO2156). DX style of tail rotor drive wire support is now available in a package of three (KYO3121). The metal mixing base that is standard in the SX kit is available as an upgrade for the SE and DX. The special wire pitch rod for the metal mixing base comes in a pack of four (KYO5106). As many advanced fliers are buying 30-size ships as fun machines for barnstorming, we suggest the SX instead of the SE. The SX may cost about \$60 more than SE, but the amount of upgrades in the kit far exceed \$60.

A very practical accessory from Century Import/Helicopter World is the small diameter metal starting cone that Century designed for the Kalt Enforcer. It fits the Concept perfectly. This cone allows you to use your existing 60-size starter extension like those made by Miniature Aircraft. Especially, if the Kyosho Jet ranger fuselage is installed, the rear starter hole on the fuselage can be enlarged slightly to allow the MA starter extension to fit through the hole. Surprisingly, adding the Jet Ranger fuselage really doesn't reduce the performance of the Concept. The top speed is just as fast, but I think the acceleration is slightly slower, but at most by only 5%. However, it looks great with the scale fuselage!

A one-ounce or two-ounce fuel tank can be strapped to the left side of the frame to further increase the flight time. This is called a feeder or header tank. Instead of having the fuel line from the main tank going to the engine carburetor, connect it to the vent on the small header tank. Then, connect the pick-up line from the header tank to the engine carburetor. With small helicopters, like the Concept and Enforcer, the engine tends to run rich when the tank is full and becomes lean when the tank goes down to a third. When the fuel level reaches one third, you need to land the model and open the needle valve by four or five clicks to prevent the engine getting too lean, overheating, and quitting. This procedure is necessary on the Enforcer, too. Even though I don't really have severe cooling problems with the Concept's rear intake cooling system, the Enforcer's front facing intake does seem to work more efficiently. In forward flight, the Concept has to suck in cooling air

from the low pressure air-void region in the back, and the engine does seem to run hotter in Concept than in Enforcer.

A couple of fliers from the Silicone Valley Helicopter Club in Northern California recommended trying the Kalt Enforcer tail rotor blade pitch and blade grip parts on the Concept. They say these reduce the slop in the tail rotor system. Equivalent or similar Kalt parts for the Enforcer seem to be cheaper than Kyosho's parts for the Concept. However, my fellow fliers and I also noticed, the plastic parts molded by Kyosho for the Concept seem to be superior to any others. This may be due to the vast experience Kyosho has in molding parts for their large RC car line.

A nice touch in Concept kits is that they come with a steel glow plug/engine nut wrench. This is an extremely convenient tool that can be used on the Concept and any other helicopter, too.

Even though the SX comes with the red "harder" rubber O-ring for increasing blade flapping stiffness, the blades still flap too easily. What Kyosho should have done is make the red rubber O-ring larger in outside diameter. Thus, the rubber would be compressed tightly inside the main rotor hub to increase the blade flapping stiffness, which would then quicken the cyclic response and also increase the helicopter damping. (Note, we have explained it before, rubber O-rings in the head are not rubber dampers. They are not there to dampen the blade flapping motion. They are there to function like a spring to support the blade.) Concept's cyclic response and entire helicopter body's aerodynamic damping to perturbation would increase if the rotor flapping is made stiffer by using a stiffer spring restraint. This can be achieved by adding a 1/2-inch strip of small nylon tie wrap underneath the red rubber. Open up the main rotor hub and CA glue the strip to the groove in the bottom half of the plastic main rotor hub. Hence, when the main rotor hub is assembled back again, the red rubber will be compressed tighter. This will increase the flapping stiffness slightly and quicken the cyclic response very slightly. But, the cyclic response is still slower than most 60-size helicopters.

Another reason for the slow cyclic response is that the plastic blade grip is very thin and soft. When the blade flaps upward, the entire blade grip bends! But don't forget, it is this soft response characteristic of the Concept that makes it so mellow and easy to fly.

I do have three suggestions for Kyosho that may improve the main rotor head. First, is to increase the red rubber O-ring outside diameter. Second, make the plastic main blade grip thicker and add ridges on top and bottom of the grip to prevent bending. Third, as the pitch control arm on the Concept is on the trailing edge side, Delta-3 flap hinge offset can easily be added by making the pitch arm longer. Since I introduced Delta-3 five years ago, Delta-3 has now been incorporated on GMP and X-Cell main rotor heads as a standard feature. Delta-3 may not



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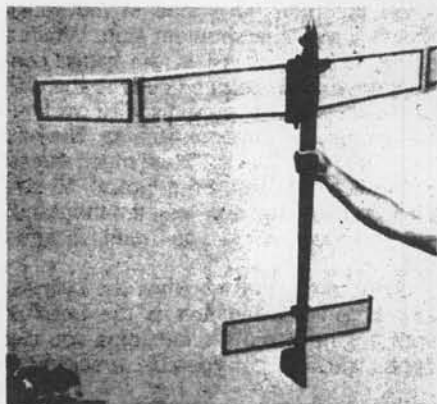
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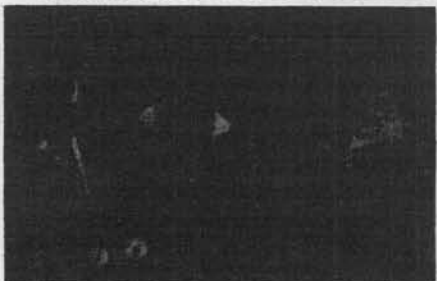
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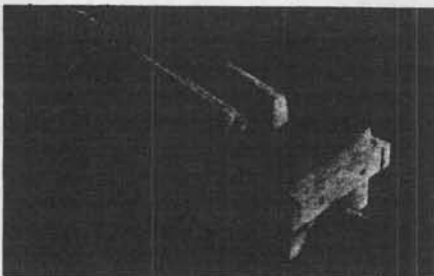
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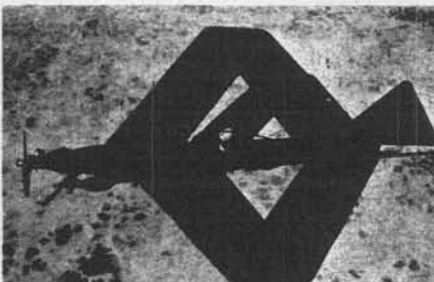
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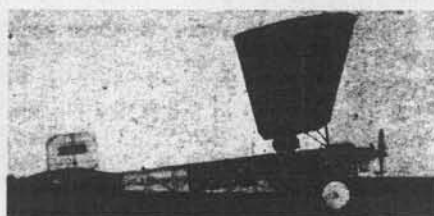
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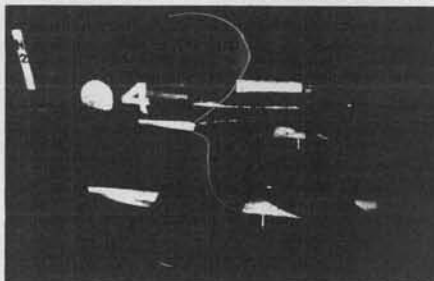
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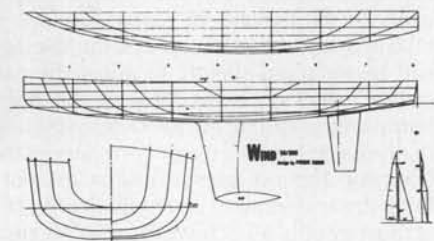
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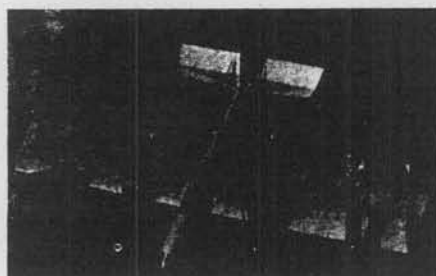
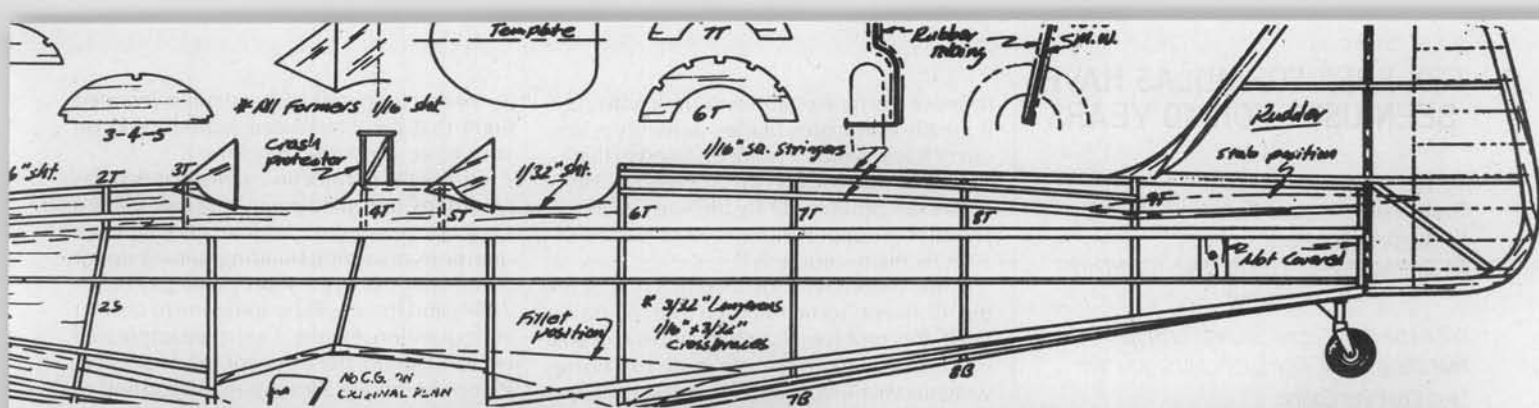
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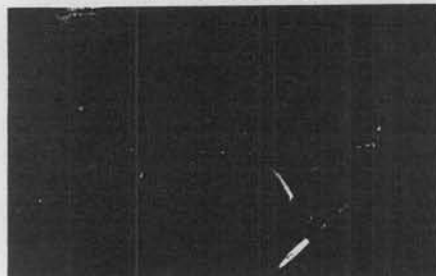
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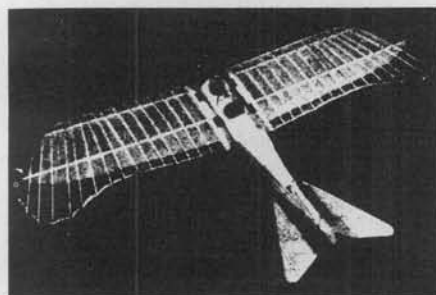
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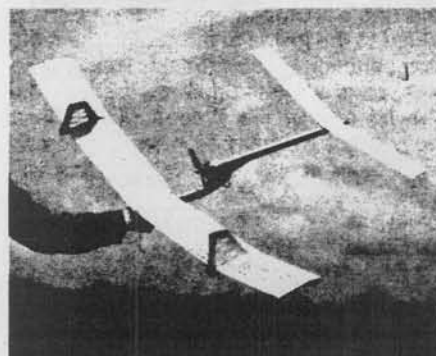
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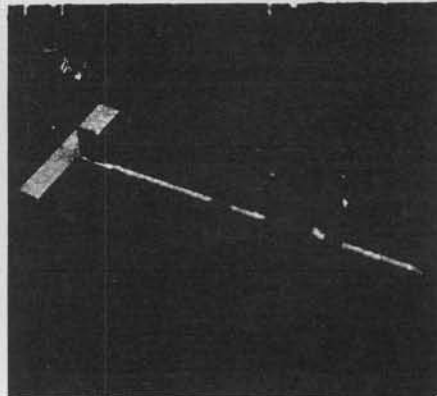
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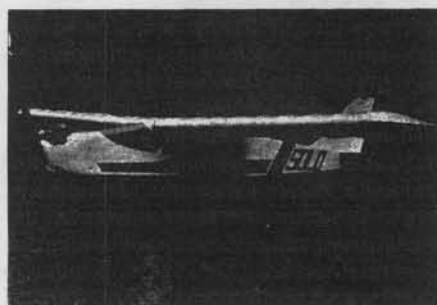
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improve the flying stability significantly, but it greatly eliminates blades suddenly going out of track. Delta-3 was explained in the X-Cell Custom review in November 1990 *2*Model Builder.*1* By the way, even the Schluter Whopper autogyro now has Delta-3 on its main rotor head!

Some fliers have indicated that blades on the Concept sometimes go out of track. Well, this problem is a characteristic of soft individual flapping rotor systems. Using weighted blades usually solves this problem because centrifugal force is increased, which effectively increases the blade flap spring stiffness. Here, centrifugal force is acting like a flapping restraint spring. Recently, I have tried rotating the main rotor blade pitch arm from the trailing edge to the leading edge. You will notice that before, the pitch arm ball is below the feathering shaft in hover. Now, it is at the same plane as the feathering shaft in hover. This kinematic change seems to have improved blade tracking. When you do this, you must also remove the main rotor shaft to flip the mixing base upside down. A local club flyer commented that he has never seen anyone's Concept blades track as well as mine. So, try the tie wrap trick and flip the pitch arm to leading edge side. However, for beginners, I suggest that you do not modify your model until after you can hover, because you have not acquired enough flight time to determine whether a mod has become beneficial or detrimental.

What's the bottom line? We love the Concept; probably one of the easiest models to learn on. Its docile handling makes it a pet among advance fliers, too. A common trait among all the plastic 30-size helicopters is that they instill confidence in pilots. Because of this, most people tend to push themselves to the edge and beyond their capability while flying them. Consequently, they make them look like a better pilot. What happens when pilots push themselves beyond their limit? They learn quicker and crash more! No problem. Our favorite compliment to the Concept is that it is probably the most crashworthy and resilient model in the world. This model can take punishment! So, take advantage of this and

go for that loop, roll and switchless inverted flight that you have been scared to do on your more expensive machine.

One of the non-technical reasons that has made the Concept so popular is Great Plane's Concept telephone hotline. If you have questions regarding building, setting up, or flying your Concept, simply call (217) 398-2834, and there will be someone to answer your question. Finally, I am quite impressed by Tim Lampe, the Concept buyer at Great Planes. He shows a lot of passion and enthusiasm in his product line. Two years ago when he took up the job, he was just an okay heli flier, but I see him at all the trade shows and contests, and he has come a long way. He is responsible for communicating with Kyosho in Japan in such matters as negotiating to keep the prices down, and feeding back American's technical input for future improvements. Tim also writes a quarterly Concept newsletter that is sent free to all the registered Concept owners. He also initiated the first 30-size RC helicopter contest.

This year's 30-size contest will again be in Champaign, Illinois, around the second weekend in June. Well Tim, a job well done. Concept's good design, plus Tim's enthusiasm, and backed by Great Planes' financial prowess, have all made Concept 30 probably the best selling model two years in a row. Concept 60, which is also plastic and resembles the Concept 30, will be released in April/May. Will it be as successful? We shall see. **MB**

CHATTER Continued from page 43

and electronic speed control for electric helicopters. What was neat at the Airtronics booth was the new Infinity helicopter radio. At last, it will be here this summer. It has an LCD screen display that's similar to the Futaba 1024 and JR PCM-10. It has five different pitch curves, dual rates, throttle curves, etc. The most interesting feature is that the modeler can elect to fly on any one of the 50 available frequencies by touching the screen. Now, you never have to wait in line at the club field anymore! Also, there is *continued on page 92*

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There you are, standing on the edge of your favorite hill. The wind is blowing 20 mph straight into the slope. Your glider is in one hand and your radio in the other. With a mighty heave you launch your pride and joy out away from the hill. The glider finds lift and continues to climb.

Then you put your plane through its paces; loops, rolls, inverted flight, snap rolls and spins. Everything your little heart desires. Not a sound anywhere except the whistling of your plane as it flies along, powered only by the wind. Someone mentions that the sun is going down and your flying time is over.

You bring your glider around behind the hill and set up for landing.

It flies right up to your waiting hand and you catch it to complete a perfect flight. And the best part is your buddies saw it all.

No wonder slope soaring is one of the fastest growing areas of our hobby. Everything from scale, slope racers and fully aerobatic models are now available and being constantly refined and improved.

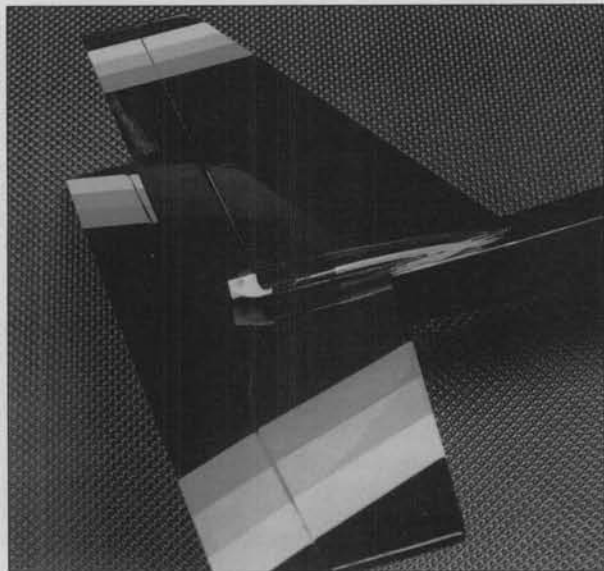
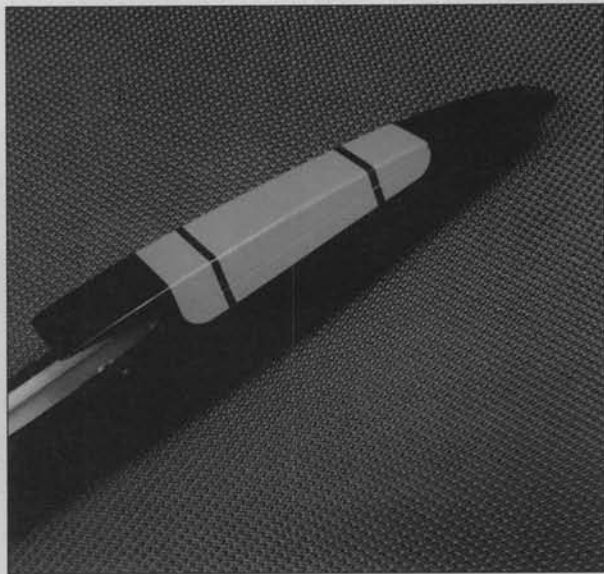
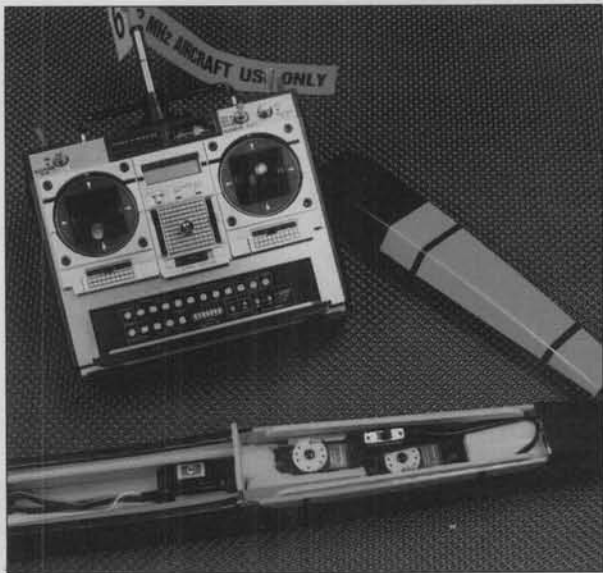
Not to be outdone, Sig Manufacturing's Mike Pratt has designed and developed a newcomer to the market. He calls this new addition the "Ninja," the subject of review for the month. When designing the Ninja he

wanted to insure that it would be one of the finest slope soaring kits on the market. This would be no easy task considering the number of quality kits now available. His design parameters were:

1. Outstanding Flight Performance:

The model must be very forgiving and easy to fly yet aerobatic enough to please everyone. Eventually the Eppler 374 airfoil was chosen because of "its superior inverted performance, high speed range and its excellent lift to drag ratio." Low speed stability has been built into the foam wing panels using one degree of washout at the wingtips.

(Clockwise from top left) Airtronics airborne system stuffed in carefully. Watch clearance of receiver and aileron servo! Transmitter is Module Series MD 7SP with its mouth . . . er . . . access hatch open. • Hatch color extends down past actual separation line for more realistic appearance. What, you never saw an orange canopy? • Charcoal MonoKote covering with red, orange, and yellow trim creates a very Ninja-like atmosphere. • Generous control surfaces tell you the Ninja is capable of very nimble performance. Photos by ED KREISER PHOTOGRAPHY



2. Easy to build:

Using die-cut Lite Ply fuselage sides and formers that lock together and a balsa sheeted foam wing, allows you to construct the Ninja in half the time you would spend otherwise.

3. Appearance:

I remember the first time I saw the Ninja in a model magazine. Something about it caught my attention. The low frontal area and striking appearance gives you the impression it's going 100 miles per hour when it's standing still.

Another plus with the Ninja is the size of the model, which allows the use of standard

size servos and battery pack. No mini radio required here. Even with the third servo added for rudder control, the overall weight is 32 ounces. With the 500 square inch wing area, this gives a wing loading of 9.2 ounces per square foot. Well within the acceptable limits. After reading through the instruction manual, you realize this is a quick and simple building model. There are more than 100 photos to help you build your model in the least amount of time. But enough about the design, let's start building.

4. Wing Construction:

The foam wing core cutting was excellent and required only light sanding to remove a

couple of cutting wire marks. The 1/16-inch balsa wing sheeting was glued together and then sanded flat. Using the measurements shown, you then cut the sheets, producing four wing skins. Sig Core Bond was brushed evenly on both sides of the foam cores and to the four balsa wing skins and allowed to dry for two hours. Carefully attach the skins to the cores and then put the sheeting wings back into the foam shipping cradles and let set, weighted down, overnight. After trimming off excess balsa, add leading and trailing edges and wing tips. Wing halves are then shaped, sanded and joined using two-inch glass cloth strip supplied with kit. I used



Kit contents. If you can get it all back in the box, with lid closed tight, you'll have no trouble installing the radio! Photo by the author.

the thin CA method of attaching the tape and job was finished quickly. The ailerons are now shaped and fitted to the torque rods. You must tape the finished ailerons to the back of the wing to finish shaping the wing tips. When finished, the wing tip will be the same shape and thickness as the aileron. Carefully block sand the wing and you are finished.

5. Fuselage Construction:

This would be my first experience with Lite Ply fuselage construction using the "Tee Lock Alignment Tab" method. You would have to try real hard to build a crooked fuselage. Everything went together perfectly. The only modification I made was to drill an extra hole in former Number Two for the rudder cable. This is necessary if you plan to use rudder control in your Ninja. I had decided that since the plane was advertised as an aerobatic radio control glider, I would need it. The construction manual shows you all the steps to make this modification.

After the basic fuselage is complete you then build the removable canopy directly on top of the fuselage. The only real concern here is not letting the CA glue run down and bond the two assemblies together. I found using thick CA glue and an accelerator worked well together here. The fuselage is now finally shaped using 220 grit sandpaper, molding plywood and balsa together to form one sleek looking fuselage.

I attached the vertical and horizontal stabilizers now rather than later as the instruction shows. I have always liked to cover the fuselage and tail pieces as one unit rather than cover first then attach them. All dings

and gaps were filled using one of the lightweight fillers. I really appreciated the ease in which the model went together. The choice of building materials and giant photo illustrated instruction book really allows you to be flying in the least amount of time.

6. Covering the Ninja:

Part of the striking appearance of the Ninja comes from the color scheme. I chose to stay with the all black, trimmed in red, orange and yellow. As you can see by the photos, I used orange to create the canopy instead of silver, and added one half inch in depth to give a more realistic appearance. All control surfaces were attached using the Sig "Easy Hinges" supplied in the kit. This product is all I ever use, whether for gliders or power ships.

The only thing left to do before installing the radio was to apply the supplied Ninja decal and here comes my only complaint. The decal is yellow trimmed in black pin-stripe. When applied to the black wing, the yellow is so thin that you see the background through the yellow, making the overall appearance something less than desirable. You also lose the effect of the black pinstripe altogether. What I did was to remove and discard the decal and make one out of yellow trim MonoKote and outlined the letters using red 1/16-inch pinstripe. It took a lot of extra work but the final effect was worth it.

7. Radio Installation:

The manual shows both the two channel and three channel radio installation. Although there is enough room you must plan carefully to get all your equipment in. Using

the extra servo for the rudder up front means the receiver must go in the wing area of the fuselage. Make sure it does not interfere with your aileron servo. All servos and the switch are servo taped in place and hidden by the removable canopy. The Ninja balances, according to the plans, at 4 to 4-1/2 inches from the leading edge of the wing, depending on your slope experience. Mine balanced right between these two figures and that is where I left it. Nothing more to do now but get some pictures and then go fly.

We are blessed here in Bakersfield with a gorgeous hill east of town. The face is approximately 400 feet high and is free from any obstructions. It's about one quarter mile in length and creates a number of shallow bowls. We have shared this slope with hang gliders over the years without any problems. The wind averages about 8 to 20 miles per hour, but can reach as high as 30 miles per hour in stormy weather. On any given day you will see just about every type of slope glider represented, but never a Ninja. That is until now!

Flying the Ninja was everything Sig said it would be. It flies light enough to float on the gentle breezes and yet clean enough to penetrate strong winds. Put the nose down and the Ninja gains speed quickly. Loops and rolls are crisp. Inverted flight is effortless. The added rudder control makes spins easy and beautiful.

In summary, the Ninja kit is easy to build and the completed glider is a joy to fly. Sig has entered the aerobatic radio control glider market with a winner. The Ninja truly is the 'Black Belt' of slope soaring. **MB**

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CHATTER *Continued from page 86*

a built-in frequency scanner that scans all 50 channels to see which channels are presently being used. The sophisticated heli radio will retail for around \$1500. The software, electronics (except the RF section), and transmitter case were all designed in the USA. Guess what! Bob Renaud, of Airtronics, says Airtronics will sell the Infinity to Japan, too. Good, that will be a step toward reversing our trade deficit with Japan.

The new Hitec 7H, Focus 5H, and Kyosho 6H were also shown at the show. We do not have much information on them. They are relatively inexpensive, and have all the necessary heli features that beginners need. We will have to see if these radios are as good as the Japanese imports.

Nick Nicholas, from Vortex Precision, of Anaheim, California was at the show, displaying five different TSK helicopters. Vortex imports the TSK models from Japan. TSK models are extremely expensive, but the quality is exceptional. Top-of-the-line model is the \$2000 Black Star. This is the model flown by Robert Gorham at the 1990 Winter Tangerine Contest. The next in line is the Super Kaiser for \$1600, then the Kaiser for \$1200. All TSK kits are pod-and-boom. Besides these 60-size machines, TSK introduced a new 30-size all-metal construction helicopter for 1991. It's called the Super Star 30, and it costs a whopping \$1000. Why are TSK kits so expensive? It's because the metal parts are all very carefully machined and cut. The quality is superb. Parts are all produced on a limited basis. Even the nylon main gear is machine cut instead of molded as in all the other models. When you move the collective bellcrank, you can feel the smoothness. These expensive and high quality kits are definitely not aimed at the beginner market. My friend Dr. Michael Jones was at the show, and he was about to shell out \$1000 right there for the TSK Super Star 30. But there weren't any yet in the country. Well, when Mike gets one, maybe I will be able to borrow it from him and review it for you. Mike, can I hover it inverted off the deck? Let me try a snap roll!

Kalt helicopters were displayed at the Hobby Dynamics booth. Only the Enforcer and Whisper were shown. We reviewed the Enforcer last month, and we will have the story on the Whisper in the next issue. For people who missed our Kalt Excalibur review in August and September 1990 issues of *Model Builder*, let me repeat here, the Excalibur is a fine 60-size model. It is extremely stable in hover. It tracks well in forward flight and has very predictable handling characteristics. I love it! The only weak points are its clutch shoes that tend to break (can be easily fixed by replacing with MA or GMP clutch), and forward flight penetration in the wind is slow. Static stability is influenced by gusts more than others. The usual comments by fliers who own Kalt machines is that Kalt models fly great but they have trouble getting parts fast enough. Readers have called and asked me where

they can get replacement parts. Folks, call Hobby Dynamics direct. Their computer should be able to tell you if they have the part in stock or not, and how soon the hobby shop can get them. You hear that David?

Miniature Aircraft USA was also at the show. MA seems to be doing extremely well. With almost all of our radios, engines and kits coming from overseas. MA is the only helicopter kit manufacturer in the USA. Tim Schoonard gave me a half-hour run-through on 17 new MA products that will be introduced in Spring 1991. Tim patiently explained the reasons behind each new item. Quite a friendly chap. If you own an X-Cell and have any technical question, just call Miniature Aircraft USA. Usually Tim or someone else will help answer your question. This is definitely an incentive to buy their products. Miniature Aircraft is owned by the Schoonard family, and when talking to them you can feel it in the air that they really care about the business. If there is a defective part or any complaint, they listen. Their number can be found in their ad.

The new accessories from MA include a plastic servo tray. This optional item will speed up the X-Cell building time. There will be a swashplate anti-rotation bracket similar to that on the GMP Legend, but this one has a ball bearing in the slot and it allows swashplate phase change. We explained in March "Chopper Chatter" that most model helicopters do not have the flybar tilt and blade flapping exactly 90 degrees "after" a swashplate input. In hover, the phase is less than 90 degrees because of the rubber O-ring or rubber damper that makes the rotor head "stiffer." In forward flight, the phasing becomes greater than 90 degrees. This item will allow you to adjust the phasing to improve hover or forward flight, but not both at the same time. Only electronic programming can do that.

There will be optional longer flybars. They range from one to two inches longer. A longer flybar in general improves controllability and stability at the same time (Explained in detail in October and November *Model Builder*). To strengthen the X-Cell wooden servo tray, there are servo tray reinforcement linkage arms that look like pushrods. A brass bushing/spacer is offered to fit inside the elevator control plastic swing arm. This allows you to torque down on the 3mm bolt that goes through the swing arm to reduce slop. Without this bushing, if you torque down too much on the 3mm bolt, the swing arm cannot swing up and down. In addition to the U-shape Magna pipe, a straight length tuned pipe will be offered. I think these new pipes may be made of composite material instead of aluminum.

DY brand F1 fiberglass blades for 60-size competition helicopters will be imported from Japan. About \$130. A 15-tooth pinion gear will be offered for the tail rotor drive pick-up that meshes with the main rotor gear. Stock kits come with a 16-tooth pinion. The 15-tooth pinion will speed up the tail rotor rpm for super fast tail rotor response. MA's Northern Product kevlar tail

blades should be used because the rpm will be higher.

A Unilock starting system will be offered. It is the same starting system designed for the Triumph helicopter. It looks similar to Kyosho's starting system for the scale helicopter fuselage for the Concept. The stock aluminum cone on the X-Cell must be replaced by an aluminum cone with a cross groove cut into it. The new longer main rotor shaft for the X-Cell 60 will come as a kit with spacer washers. And there is an optional nylon spacer for you to shim between the collar at the bottom of the shaft and the main gear to reduce the shaft length in about 1/8-inch increments. There will be black or white rubber hoses for landing skids to reduce landing gear strut wear. And, we already mentioned the Magna 30 fuel.

Keeping up with the vogue, there will be a limited-slip driven tail rotor system for the X-Cell 60/50/40/30. The popular West German-made Wiha tools with black handle and red tip will have tools made reversible. For example, the flap head driver shaft can be pulled out, and inserted back in the handle to expose a Phillips driver on the other end.

X-Cell 30 kits will now come with a new clutch lining. Finally, there is a new vinyl-like hard tubing to fit inside the Delta-3 tail rotor hub on X-Cell. Remember in our X-Cell Custom review, we pointed out that silicone fuel tubing was used inside the teetering Delta-3 hub that tends to get chewed up after a month of flying. Furthermore, the tail blades flapped too easily. Well, try this hard vinyl tubing. I flew Gary's X-Cell 40 with this tubing (before he rammed into my Champion), and the tail response was excellent.

That was a long list. Most of the stuff was not available at the time I wrote this, so I have not tried any of them, except the tail tubing. When they come out and if we have a chance to try them, we will let you know how they work. Meanwhile, Tim says a new 30-page catalog should be out by the time you read this. Give Miniature Aircraft a buzz for the catalog.

Great Planes was at the show displaying the ever-popular Kyosho Concept 30. They displayed a large two-foot size photo of their electric EP Concept hovering inverted. Quite impressive! Mike Forrester told me that his friend Greg Melosevich was trying to fly an electric Whisper inside a motel room at the Merced Funfly. One guy was holding the Whisper inverted, and then released it. The objective was to "land" the helicopter on the ceiling! Well, Mike says unfortunately it crashed into the bed (if you try this, don't say you read about it in Model Builder.wcn).

The Concept 60 was not displayed at the show, but, it will be here in the US around April or May. It is mostly made from glass-filled nylon parts. Servo tray, engine location, and main rotor head are just like the Concept 30. It has an individual flapping main rotor head but with lead-lag damper. This would be the first RC model kit in the

continued on page 96

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Edjer Lube-Not Just An Ordinary Oil

BY RICHARD A. YOUNG AND SCOTTIE DAYTON

To successfully hone any knife or tool, some type of lubricant must be applied to the sharpening stone. In the past I've always grabbed my can of Smith's Bear Honing Oil. Then I was given a bottle of Edjer Lube to test. This non-toxic, non-allergenic, biodegradable oil is touted to be superior to any other similar product. The literature accompanying the sample was intriguing. It claimed Edjer Lube to be an outstanding lubricant as well as a continuous cleaning agent.

The sales rep advised me to recondition my sharpening stones before testing. Following his instructions, I applied a drop of Edjer Lube, then washed my medium Arkansas stone with full strength Arm & Hammer liquid laundry detergent (any detergent will suffice). After the stone dried, I put on another drop of Edjer Lube and worked it in with my finger just like the salesman had illustrated. He had warned me that over-application can actually keep the product from performing at its best. The rule of thumb suggested was that if I could see the oil on the stone, I'd used too much. One drop truly was all that was needed, and it went a long, long way.

Realizing that it takes a while to become familiar with a new product, I sharpened quite a few knives and tools to give Edjer Lube a fair test. One of its advantages according to the promotional literature is ease of sharpening. Because the blade floats on the stone, less pressure is required. Reducing the cutting forces results in a sharper edge. After a lifetime of sharpening knives with honing oil, I've become accustomed to feeling the blade bite the stone (it assures me that something is happening) and to seeing a bead of oil build up on the edge of the blade (this tells me that the cutting edge is in contact with the stone). Edjer Lube robbed me of these two features. There was so little friction between the steel and stone that I assumed nothing was happening. There also wasn't any bead forming. An old dog like me found this new trick too hard to master, and for that reason alone I prefer my Bear Honing Oil.

Edjer Lube, however, has many more uses, and I proceeded to test these. Nor-

mally I don't oil or spray silicone on a knife when working on a carving. Because Edjer Lube isn't supposed to contaminate other materials, I put a little on my blade to see if it would reduce the friction of steel through wood. I was removing quite a lot of stock for this experiment. Without any dedicated equipment to measure the forces involved, it's difficult to judge the outcome, but I feel Edjer Lube did help the blade move more easily through the wood. Most importantly, it left no residue. I intend to impregnate a rag with Edjer Lube and wipe down my knives every time they're sharpened.

Another claim is that Edjer Lube won't attract dust or dirt or become gummy. As a test, I applied some to the teeth of a new 8-inch hollow ground veneer blade. After cutting hundreds of feet of hardwoods and pine, the blade is still sharp and there's no evidence of any gum buildup. I've used spray silicone in the past on my blades and never was pleased with it. Edjer Lube is the answer. It performed beautifully. I'm going to recondition all my saw blades and band saw with it. I'm even planning on wiping down my drill bits.

Edjer Lube is wonderful for lubricating tools which will come in contact with a finished product, because it isn't oily or gummy. It has yet to leave a trace of itself on anything! Even my hands stay clean with none of the slick feeling one gets from other lubricants. Since Edjer Lube is a combination of refined vegetable-based triglyceride fractions, it poses no hazard to the user.

I generally don't have a problem with rust on my tools, but if you do, I suspect that the following statement is true. Edjer Lube, as a cleaning agent, doesn't dissolve foreign materials. It goes beneath the debris to replace it. Rust is prevented due to this adhering quality. Water and other harmful rust-causing elements are unable to break that bond.

My bottle of Edjer Lube is on my workbench within easy grasp, and I find myself reaching for it for more and more applications. I'm pleased with the product and will buy a replacement bottle when this one is empty. Edjer Lube is available from Edjer, P.O. Box 8, Moorpark, CA 93020. **MB**

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WINNERS ANNOUNCED!

Just by subscribing or renewing their present subscriptions to *Model Builder*, **Frank B. Abbott**, of Coral Gables, Florida, has won an Airtronics Spectra PCM radio control system; **Jean G. Paillet**, of Brookville, New York, has won an Uber Skiver knife set, and **Len D. Singer**, of Blacksburg, Virginia, and **Richard G. Whitehead**, of Sonora, California, have each won a six-month extension to their *Model Builder* subscriptions.

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world with lead-lag damper. Purpose of the lead-lag damper on a helicopter is to prevent air or ground resonance. Air or ground resonance is often seen on model helicopters. When it happens, the model oscillates laterally, or longitudinally. Similar to the Kalt Enforcer, Concept 60 has the main rotor gear and tail rotor drive pickup completely enclosed in a case to seal out dirt and grease.

A Concept 30 item that I found very useful

is the Kyosho main blade balancer. It is a teetering balancer that can be used for 30 to 60-size rotor blades. It allows you to balance the two blades statically. Usually, if the blades are statically balanced with this unit, you should have very little vibration. I have used this balancer for the last six months and I like it. A more sophisticated balancing act, like the Hostetler method, may improve rotor balance further, but with a lot more time spent. For beginners and average fliers, the Kyosho balancer would be sufficient.

(Not mentioned by James Wang . . . probably because he sees so much RC helicopter flying . . . but enjoyed by several thousand spectators throughout the weekend, were the outside demonstration flights put on by Tim Schoonard of Miniature Aircraft USA and Tim Lampe of Great Planes Model Distributors. Tim Schoonard flew his X-Cell 30, while Tim Lampe flew the Kyosho Concept 30 and Concept EP electric helicopters.-wcn)

Finally, I finished my trip to California with a visit to an impressive hobby shop that sells only RC helicopter stuff. The store, Helicopter World/Century Import, is located in San Jose, California, which is about one hour south of San Francisco by car. The owner, Peter Chao, says he does almost 85% of his business through the mail, and the rest are walk-ins. The moment I walked in, I saw an impressive collection of parts for Kalt, GMP, Hirobo, X-Cell, Schluter, and Kyosho. I counted 47 X-Cell kits stacked in the corner, and there were 26 Shuttle ZX, 30 Schluter kits, four Legends, and umpteen Concepts and Enforcers. I wish this shop was next door to my house!

It was interesting to learn that Helicopter World/Century Import now has the most diverse collection of scale fiberglass fuselages for 60-size mechanics. The inventory includes: Bell Huey UH-1 utility helicopter \$259, Bell Huey AH-1G Tow Cobra gunship \$369.95, Apache AH-64 \$379.95, Sikorsky UH60A Black Hawk, British Westland Seaking \$329.95, Airwolf with retractors \$289.95, and a 30-size Airwolf \$129.95. Peter says they also make their own Black Shark and Nova fuselages for 60-size FAI competition machines. Black Shark \$225

and Nova \$235 are currently the most popular fuselages for competition in Japan. Mr. Dobashi won the 1989 World Championships with a Hirobo SST Eagle inside a Black Shark fuselage. Cliff Hiatt also won 1990 Tangerine with an X-Cell 60 inside a Black Shark fuselage.

As I visited the store on a weekend morning, the owner, Peter, took me to the local helicopter flying field. I met the president of the local Silicone Valley Helicopter Club and at least ten of its members. They put on a good aerobatic show for me. Three of the members were doing switchless inverted flying. Afterward, ten of us went for lunch and a two hour BS session on helicopters.

RC helicopters have definitely come a long way since 1970. Back in the 70's I could not have imagined that there would be hobby shops selling only RC helicopters. Copter Corner in Los Angeles is another one of these new heli-only shops.

If you have a helicopter hobby shop or helicopter club, send some pictures in and we will show the readers. And next time I go on trips I will try to swing by you. Oh, send a map, too, so I can find you. If you have technical questions, you can also write me, I will try to answer within three days if you include a self-addressed and stamped envelope. My address is P.O. Box 692, College Park, MD, 20740. And the phone number is (301) 589-0855. Okay folks, we will let the pictures do the talking. Next month we will have our interview with Wayne Mann. The following issue we will have a highly technical column on the impact of different rotor blade airfoils on performance. **MB**

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FREE FLIGHT *Continued from page 47*

pieces. Some time later, my glider proudly finished and flight tested, I took the glider to the highway where the road entered from the mountain above. I threw my glider out over the canyon below. That was the last I saw of my glider, as it rode a thermal or mountain wave out of sight. I had watched many hawks and buzzards do this, and now I had done it, or rather my glider had. It mattered not, I was hooked. I had become a

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One of the cottage industries that provides free fliers with the equipment and supplies that we have difficulty finding in the local hobby shop is Champion Model Products. George Schroedter, proprietor, announces that Champion is still in business. Like many cottage industries, Champion is a one-family or one-person operation. George notes that he has had difficulty keeping up with the orders for kits, and that he is suspending production of all kits during 1991 until he has a chance to catch up with himself. He will also not mail out new catalogs until 1992. Now, if you want to order from Champion, other than the kits, George will send you the 1990 catalog with an updated price sheet.

George sells the Acculab electronic gram scales in two weight capacities, a wide selection of free flight balsa, engine and D.T. timers, as well as the usual other supplies and kits as long as they last. As is usually the case with people who begin supplying items for select audiences, cottage industry folks usually give up much of their own free time, read: no more model building or flying. Consequently, the spare-time activity started to help others becomes a full-time occupation, usually in conjunction with another full-time job. So it is with George. If you are interested in a 1990 catalog with a 1991 price list or any of the items listed above, drop George a line at Champion Model Products, 880 Carmen Ct., LaVerne, CA 91750.

BOB PECK

I just read in the Fresno Model News that Bob Peck, of Peck-Polymers, passed away. Bob and Sandy Peck have been a mainstay of free flight products for many years. Recently, their entire operation suffered a devastating fire, but they reconstructed and went on with business as usual. I last saw Bob and Sandy at the Tri-Cities Nationals where both of them were as enthusiastic as the last time I had talked to them. Bob's loss affects all of us, and we will miss him and what he brought to us.

I understand that Sandy plans to continue with Peck-Polymers. I hope so.

HUMOR FROM ACROSS THE LAND

I recently received a copy of the *AMA National Newsletter*, and I really enjoyed the following recipe, which was lifted from Tom Wilk's Duluth, Minnesota, RC newsletter. It relates to Christmas, but it will work anywhere. So, here goes:

"With the holiday season upon us once again, Gwennie Rogers has graciously offered to share a wonderful cookie recipe that has brought joy to all who have tried it.

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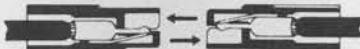
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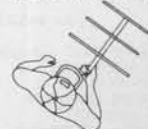
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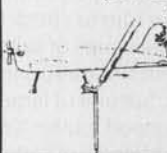
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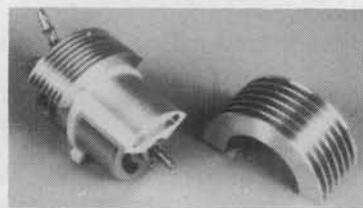
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right. To be sure the rum is of the highest quality, pour one level cup of rum into a glass and drink it quickly . . . repeat. With an electric mixer, beat one cup of butter in a large fluffy bowl. Add one teaspoon of sugar and beat again. Meanwhile, make sure the rum is of the finest quality. Try another glass . . . let stand 10 minutes. Repeat. Open second quart, if necessary. Add two arge leggs, two cups fried druit and bat 'til high. If druit get stuck in beaters, just pry it loose with a drewsdriver. Sample rum to check to tonsicistricyh. Next, sift three cups of salt . . . or pepper? (It really doesn't matter), sampling the rum as you work. Sift pint of lemon juice as you fold in chopped nutter and strained butts. Add one babletoon of brown thugar, or whatever color you can find. Wix

mell. Grease oven and turn shoockey ceet to 350 gredees. Now . . . pour the whole mess in the coven and ake 'til thoroughly brownish . . . check the rum again and bo to ged."

THAT'S IT DEPARTMENT

I hope you enjoyed the May edition of *Model Builder* Free Flight. You don't have to catch a thermal for me this month, as I hope that I can catch my own now that the weather is improving. Instead, catch one for yourself. It's time to fly again. **MB**

RC PRECISION *Cont. from page 53*

can't see what you're doing, believe me, you are not going to get the benefit of the doubt. What you are going to get is a score

that resembles the number of exemptions on a confirmed bachelor's tax return.

Double stall turns are presented in a similar manner, with the added proviso that the maneuver be exactly centered on the pilot, and the flight path connecting the stalls be a half loop. Obviously, to present a decent planform view of the aircraft to the judge as the turn is executed, the connecting half loop is going to have to be pretty large. One of the things you must guard against here is the practice of flattening out the bottom of the loop in an effort to make the maneuver wide enough. And again, the return paths need to exactly parallel the entry paths.

For both the single and double stall turns, it is a good idea to maintain enough distance out so that a crosswind doesn't bring you in

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too close. An aircraft slowing down at the top of a stall turn is very susceptible to wind drift, and drifting in can result in a big downgrade for exceeding the 60 degree frame, or even a zero for crossing the line. This is probably the most common downgrade for most Novices (and some Sportsmen!) next to flopping the turn itself. As you progress, you will learn to finesse the throttle and rudder (or very slightly drop a wing) to keep the bird tracking a straight path in the wind to minimize this effect, but for those just learning, a little extra room doesn't hurt.

Loops are about as basic as stall turns and subject to similar ills, with the key again being a level, parallel entry. Pattern loops are *round* unless some other shape (square, for instance) is specified. I mention this

because I have seen myriad other shapes performed. In fact, round loops are extremely rare. Perhaps if most of us called the maneuver we were actually going to do, we would score better. You know, something like, "Three irregularly elongated oblate ellipses in the vertical plane, inclined on a longitudinal axis of 15 degrees to the horizontal, are next. Maneuver beginning now." Whether eggs or loops are your forte, three loops means three superimposed loops; one right on the path of the other, same size, same shape, same spot.

From a straight and level entry, a well trimmed pattern plane just about loops itself. Most of the big problems people have with loops can be traced to overcorrecting for small problems. Similar to what we did

with the Stall Turn, do loops end-on to your line of sight so that you can be sure that the aircraft does behave decently from a wings level entry. If it doesn't behave, fix on it until it does. If you get stumped, get help. There is sort of an unofficial "trim committee" operating at most RC fields, and reams of stuff has been written and published on the subject. Appealing to the ego of the nearest pattern pilot is usually sure fire. If that doesn't work, call me. There are even people I can call who *really* know, if all of us should get real stupid. You should start with sealing the aileron gap, and making sure that both elevator halves go up and down the same amount (and hopefully at the same time!).

The larger the loops are that you do, the harder it is to maintain symmetry and con-

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gruity. On the other hand, tiny loops are rightly downgraded for lack of smoothness and gracefulness. A medium large maneuver is usually best. Aircraft performance is obviously going to have a heck of a lot to do with the size of your loops. The judge has been told to disregard aircraft performance and look only at maneuver shape, but maneuver shape (and size) is inexorably bound up with the aircraft's performance envelope. In particular, with loops, we are talking about maintaining adequate airspeed over the top of the maneuver. Like a fighter pilot, you have a need for speed, especially in vertical maneuvers. Speed keeps the aircraft tracking, minimizes wind drift, and keeps control response crisp. Fly loops according to the available horsepower. If you feel the plane getting sluggish over the top, ratchet the size down until you get the solid feel back.

With a loop, the wings should remain level throughout the maneuver. Consecutive loops that drift in and out (toward the flight line or away) most often result from entries made in a bank. Is this starting to sound familiar? Places to check for wings level are on the entry and coming over the top. With most aircraft, it does help to back off the throttle a bit on the back side to maintain roundness. On the first loop of three, fix a top and bottom point against the background (trees, clouds, mountains, etc.) and concentrate on nailing that point on the subsequent loops. A judge will best remem-

ber the last thing you show him/her, so if you change sizes a little on the second loop, make darn sure the last loop matches it, and then draw a nice straight exit line.

The one mistake that always fetches a huge downgrade is the segmented loop. The pilot starts flying the ailerons or rudder or throttle so much that the elevator gets taken for granted. All of a sudden, the pilot notices that his/her nice round loop isn't, and jerks on the elevator. Each jerk burns a nice little corner into the judge's eyeball. A closed maneuver in the vertical plane with 23 sides may be unique, but it isn't a loop.

Outside loops (actually, **reverse** outside loops in the patterns currently being flown) are identical to inside loops as far as the internal dynamics of the maneuver are concerned. After all, any good pattern plane flat doesn't care whether it is upright or inverted. Starting from level entry, the aircraft is rolled inverted, pauses for greater than one second, pushes up into a complete outside loop, pauses for greater than one second, and half rolls to upright flight. The common mistake here, in addition to the ones above, is failing to observe the greater than one second pauses before and after the loop. This is amazing to me, because the maneuver is so much easier to do with longer pauses. The longer lines give you a chance to stabilize the aircraft after the roll to inverted, and again after the loop is completed before rolling back to upright flight. **There is no penalty for making the**

pauses longer than one second. The only criteria you need be concerned about are making sure everything fits in the 120 degree aerobatic frame, and making sure that the pauses are the same length. And again (I should buy a record), a straight and level entry and exit are necessary. Plus, the rolls really should be done at the same roll rate. Easy, huh?

Lack of a good firm push on the elevator to begin the loop spoils the reverse outside loop as often as the lack of a level entry. Again, it helps to back off the throttle coming over the top. Concentrate on rounding out the back side of the loop and nailing the exit altitude. All loops, inside and outside, are centered on the pilot. If the requirement is for consecutive loops, as in Three Reverse Outside Loops, then the loops need to be superimposed, just as in Three Inside Loops.

With the Immelmann Turn, we really start the process of fitting separate elements together into complex maneuvers. I suppose that something of a case could be made for the Stall Turn as well, but I think the Immelmann is really our first hybrid maneuver. The Immelmann combines maneuver elements from two different families, consisting of a half loop and then a half roll to upright flight. Looping rules apply, as do the downgrades. After our old friend, the straight and level entry, the half loop is performed and finishes precisely over the point where it was started (in front of the pilot). The half roll is done **immediately** after the aircraft comes

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level in the inverted position.

It should be obvious that this means that the center of the roll is displaced or offset slightly past the maneuver center, but it is surprising how many pilots (and judges!) seem to have bought into the idea that the roll is centered on the pilot. This is not so, and doing the maneuver that way results either in a "buttonhook" effect, as the radius of the half loop tightens up near the top, or a roll that is done on a slight upline. Both mistakes will fetch you a stiff downgrade in front of a judge who knows his business.

As with loops, a good strong engine is a pilot's best friend during the Immelmann. The common mistake here is losing heading and/or dipping during or after the roll. This is usually the result of inadequate airspeed over the top. Like I said, a good engine does wonders, especially if it is hauling a light airframe. I like to roll right, against engine torque, because I believe it holds the nose up better. The maneuver finishes in straight and level flight on a heading 180 degrees from the entry heading. Hopefully, the entry heading was parallel to the flight line, so this means that the exit is parallel as well, but in the opposite direction.

By now you must have noticed that a common theme in all of the discussions above is straight lines of entry and exit. The rulebook states that a straight entry and exit line of at least 15 meters is part of every maneuver. As with the pauses of the Reverse Outside Loop, no downgrade exists for

making the entry and exit lines too long, so long as the entire maneuver fits in the 120 degree aerobatic frame (60 degrees either side of center, and 60 degrees up from the horizontal). Form the straight entry and exit habit, and your scores will improve. We will talk more along these lines in the future.

Until then, be aware that methanol is a very dangerous chemical. Make the world a better place by destroying as much methanol as you can. Burning the stuff in a model engine is the approved method. See ya' at the field. **MB**

MERCO *Continued from page 59*

engine is fully metric . . . my General Motors made-in-the-USA station wagon is mostly metric! The Merco's prop nut is 8 millimeter. The four 3mm bolts that hold on the rear crankcase cover were loose and easily unscrewed with my fingernail. The cover-to-case seal is via a paper gasket and that gasket had compressed with time . . . a completely normal occurrence as the engine waits for you to buy it.

This engine was broken in on the new Powermaster Products Golden Break-in Fuel. The little booklet that comes with the fuel teaches much about preparing a new engine for running . . . it teaches about paper gaskets and bolt snugging before running. An engine with a slightly loose rear cover will usually start and run, but as air leaks past the

gasket, the engine will become erratic, often run lean and sizzle and non-reversible damage can occur. Model builders who've read/studied the Golden Break-in booklet say it, alone, is worth the fuel's purchase price!

As I've written before, gently snug/tighten engine bolts that pass through a paper gasket before firing up the engine. The component identification drawing that comes with each Merco clearly shows the presence of the paper gasket . . . I wish all engines came with such a helpful drawing . . . Hooray for Merco!

Other paperwork supplied repeats and repeats warnings that say . . . "Never dismantle an engine." "Do not dismantle your engine." "This guarantee will not apply if the engine has been dismantled." "On no account disturb the crankshaft and bearings in the crankcase." I AGREE! There's no justification to take apart a new model engine. Last time you got a new car, did you pull down the engine? Last time you got a new RC system, did you take it all apart?

The purpose of these articles with extreme close-up photography is to show you what's inside . . . without fouling/voiding your generous warranty. It's not uncommon for a new model engine to have near-microscopic aluminum particles left inside at factory assembly. I personally like to remove only the rear crankcase cover (scratch an "X" on the upper surface before removing) and flush the engine through that open-

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ing and through the glow plug opening before running. But if you don't, please be assured those particles come out the exhaust plenty fast.

This month's review engine had aluminum particles inside, and I made no special effort to remove them before running. Also, this engine is one of several that has the prop driver pressed onto the crankshaft with a split collet in between to lock things together. Disassembly usually requires putting in a new split collet as the original can be destroyed as things come apart... hence, the manufacturer's warning is valid. The literature also gives a warning on fuel. Fuel becomes a touchy subject in the USA as so many fuel blenders seem to give us what we want... rather than what we should have for our engines. We engine writers tend to avoid that touchy subject... I'll venture a comment that if all Sunday flying engines were forever run on Powermaster's Golden Break-in fuel exclusively, they'd deliver useful power for a much longer time. The GBI fuel is one of the world's best. The Merco instructions say: "Do not use a fuel with only synthetic oil."

The instructions also recommend, after the first few minutes of running, to allow complete cooling and then to tighten/snug the six head bolts. Study the photos and you'll see there's a paper gasket sitting atop the crankcase casting and under the cooling fins.

The photos looking into the rear of this Merco also show something quite rare in design. It's interesting to note that the axis of the steel cylinder is offset towards the exhaust side of the engine... by quite a bit. The theoretical design is twofold in benefits. This offset feature allows, on the piston's downward traveling power stroke, the downward energy translated by the connecting rod to be more nearly vertical as it pushes on the crankpin of the crankshaft. The theory is that greater downward force is translated or forced upon the crankpin during the power stroke if the connecting rod is more nearly vertical during that stroke. Side forces are minimized between the side of the piston and the cylinder... side force is wasted energy. This may account in part for an extreme uniformity in speed ratios as the performance figures show this month.

Another benefit of this offset cylinder is that it tends to allow a bigger cross-sectioned bypass in the crankcase casting... the air/fuel mix has a bigger easy-passage path from the crankcase upwards and bypassing the outside of the cylinder as the mix travels up into the combustion chamber for ignition. This theory may or may not work... most of today's engines have the center axis of the engine's cylinder directly over the center axis of the crankshaft.

Speed engines, with their piston at top dead center, sometimes have the bottom edge or skirt of their piston not fully cover the exhaust outlet through the cylinder wall... but allow a minor opening to occur at that TDC time... and allow a minor amount of fresh combustion air to enter under the

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bottom edge of the piston. This is called sub-piston induction and most Cox Tee Dee engines have this trick feature. The Merco .61 has sub-piston induction much to my surprise. This is fine for speed, but it usually hinders absolute low idle performance as it is an intentional air leak introduced by mechanical design that usually upsets fuel draw reliability as the throttle is fully retarded. Consequently, I was really curious to see the engine's idle performance after break-in. You'll see the figures are darned good and reliable down to 2,000 RPMs. As the muffler proved quite restrictive, I'd judge there is precious little (if any) fresh combustion air entering the engine under the piston. The muffler-off high RPM test reading was accompanied by a very high idle speed. This same muffler casting is normally supplied with all sizes of Mercos. It fits the .29 through .61 engines.

Six 3mm bolts go down through the cylinder head. Three of them are 31mm long and

are 120 degrees apart around the head and pass down into the crankcase casting to hold things together topside. The other three 3mm bolts are only 13mm long and fit in between the long ones. These short ones help tie the head to the cooling fins. A standard USA Phillips #2 screwdriver fits these six bolts well. The cylinder head and the cooling fins are machined from aluminum barstock. The engine comes without a glow plug . . . one Fox Miracle plug lasted through all the break-in running, testing and seemed to give better idle performance in this engine's case than my other favorite plug, the K&B 4520.

The cylinder's bore is just under 24mm (.935") and the piston's stroke is just under 23mm (.895"). The bottom of the cylinder head is one big dome that's 22mm in diameter (.870") and 4mm high (.158"). The bottom snoot of the Miracle Plug fits down into the combustion chamber about .025" or halfway. The steel cylinder is a cold slip fit down through the cooling fins and down

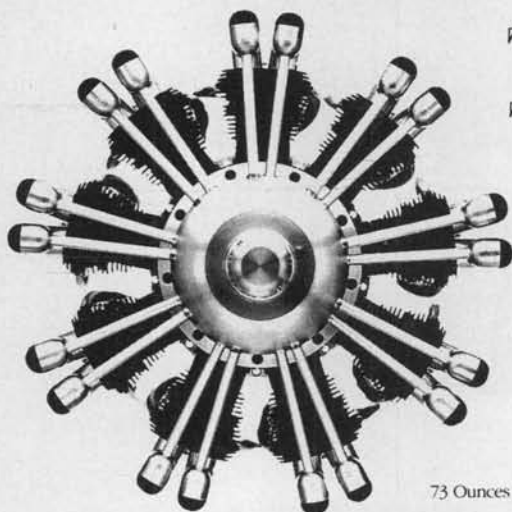
into the crankcase casting. The cylinder has four square intake windows and four higher up exhaust windows. The two round holes below the intake windows measured .250" diameter and match windows on the intake side of the piston to provide a mixture path . . . a common design feature in many two-cycle engines.

The front and back of the piston's wrist pin holes have a hard white plastic insert or filler pad lightly pressed in place that keeps the wrist pin from drifting out of place and rubbing the cylinder wall(s) and doing damage . . . simple and effective! The exhaust timing measures 143 degrees, which is conservative and lends itself to above average fuel economy by today's standards. There's lots of rotational time for the fuel to burn before the top of the piston starts to uncover the exhaust. I hear stories of the Merco .61 being used for control line aerobatics, and doing the whole flight sequence on only a four-ounce fuel tank . . . thrifty! An eight-ounce fuel tank will give plenty of RC flying time with this engine.

The compression ratio measured 9.09 to 1 . . . plenty high enough for a muffler-equipped engine. Engines made to run on tuned pipes often have lower compression ratios. The pipes cause supercharger-like action, in that they pump air back into the combustion chamber to effectively raise the compression ratio a bit.

The single piston ring is free to float/turn in the piston's groove. The ring was pre-machined a bit by some processing steps before being installed in the piston . . . it had varying areas of shiny vertical contact indicating it was partially trued to roundness and the break-in would finish the surfacing of the ring. It's an extra manufacturing step(s) performed on the ring's outer surface only that probably makes for a shorter break-in with the cylinder walls. The walls are .060" thick and are unplated . . . the cylinder appears to have been heat-treated.

The piston is cast aluminum machined on outer surfaces and has the normal deflector baffle machined on its top crown that's characteristic of a loop scavenged design . . . this is not a Schnuerle ported engine. Rather, it belongs in the same family of time



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as the Veco .61 that evolved into the K&B .61 that is still in production, and favored by many Sunday flyers for reliable slugging, slogging power today.

The intake throat of the carb measures 7mm (280") and the fuel/air passageway through the center of the crankshaft is just over 9mm (.360"). The crank's disc is heavily cut away for balancing and we judged the Merco .61 to be slightly above average in vibration as it passes through 7,500 to 8,500 RPMs . . . no big deal . . . all single cylinder model engines shake at some speed. The reciprocating mass of this engine (piston, wrist pin, plastic white pads and half the connecting rod's weight) is 11-3/4 grams . . . 28 grams equals one ounce. Both the top and bottom of the forged connecting rod are

bushed and then sliced through for about 150 degrees of diameter to allow for lubrication in these critical spots.

The carburetor is greatly improved since those early RC days . . . it's a totally modern two-needle system. High speed fuel metering takes place at the forward end of the inlet fuel line nipple . . . raw fuel enters the incoming airstream by exiting the end of the brass spray bar shown in an extreme closeup photo. As the throttle's soft steel barrel rotates to close off incoming air it rides an incline towards the high speed needle. The barrel carries with it the idle needle valve, the slight taper of which, starts to fit into the open end of the spray bar . . . this action further leans the fuel mixture . . . the more the barrel rotates, the more the mixture leans . . . that's how we get good engine idle speeds.

The single picture looking down the carb's throat is worth ten thousand words! This carb is very linear . . . it works great. It's English engineering with the right combination of travels, tapers, diameters and angles . . . nicely done, Merco! Fuel feed is best when the fuel tank's level is half above and half below the level of the carb's spraybar. There's no need (nor is there a provision) to use a pressure tap from the muffler to the tank. A pressure line simply won't remedy a poorly positioned fuel tank, as so many plans show. Carb cleanout is easy . . . remove the top-most bolt and spring . . . count the turns and **write the figure down** for future reference. Remove the tiny bolt that retains the white nylon washer. The rotating barrel will, along with its four-coil spring, now slide out of the aluminum housing. Spray through all openings with WD-40 and re-assemble. It's not necessary to change or remove the idle speed needle valve . . . simple!

As received, the engine had virtually no compression and the crankshaft-to-crankcase fit was a bit "draggy."

The little instruction booklet that comes

taped to the half gallon bottle of Powermaster's Golden Break-In Fuel was followed exactly . . . a 10-6 Master Airscrew was used for the break-in procedure. Almost immediately, compression started to increase . . . a third of the way through break-in, the engine wanted to idle rather than shut off on command . . . a great sign. Two thirds of the way through break-in, the compression was getting a nice and "snappy" feeling, especially when flipped backwards . . . also the crankshaft's "draginess" was gone. At the

Prop Size	High RPM	Low RPM	Richmond Speed Ratio
11-6	10,700	2,400	4.46 to 1
11-7	10,250	2,300	4.46 to 1
11-9(new size)	9,900	2,400	4.13 to 1
12-6	10,250	2,300	4.46 to 1
12-8	9,300	2,000	4.65 to 1

end of the break-in, the 10-6 peaked at 14,100 RPMs and the engine was nice and free and ready for testing.

PERFORMANCE

All tests performed using Master Airscrew propellers and GBI fuel and the Fox Miracle plug.

The Richmond Ratio is the ratio of high speed to the minimum reliable idle speed on a given single prop. It obviates need for temperature, pressure and humidity and related factors of weather being stated. The average engine owner should be able to duplicate these figures readily.

A speed ratio below 4:1 is unsatisfactory.

A speed ratio of 4:1 is barely satisfactory.

A speed ratio of 5:1 is average performance.

A speed ratio of 6:1 is superb performance.

With the muffler off (open exhaust) this figure became 12,100 RPMs, which indicates the muffler is highly restrictive on the minus side. On the plus side, the muffler most certainly contributes to the very desirable low idle figures we need for touch-and-go's and power-on landings. Removing the 8mm inside diameter aluminum tubing stinger from the muffler's halves increased both RPMs at high speed and sound levels too, without changing idle performance.

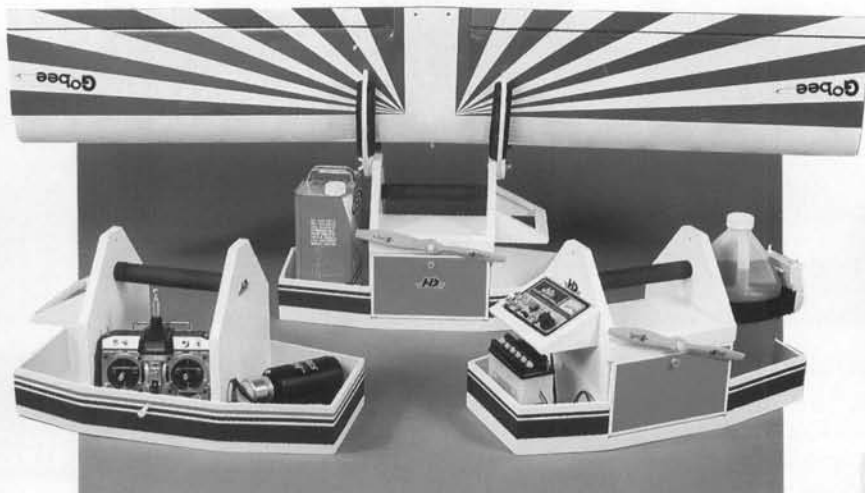
CONCLUSIONS

The Merco .61 has, in past years, been flown both in National and International contests with success. This Merco .61 RC AERO is a basic slogging, slugging sixty that'll give lots of reliable air/hours at a very low cost per air/hour. It's of straightforward, non-exotic design and manufacture, (I see no evidence of CNC machining) and it is available in several sizes at most reasonable pricing direct from Hobby Lobby International, 5614 Franklin Pike Circle, Brentwood, Tennessee 37027, and from finer hobby shops in the USA, too.

This Merco costs about a hundred dollars as this was written!

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	Before	After
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Cylinder Liner Bottom	.7681	.7685
Piston Diameter	.7657	.7657
Piston Pin Diameter	.1960	.1959
Crankshaft Pin	.1960	.1959
Wrist Pin Hole	.19685	.19685
Lower End Connecting Rod Bushing Inside Diameter	.19685	.19685

