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volume 20, number 218

MODEL BUILDER

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REVIEW:
Schluter Magic Helicopter, Pt. 2
GMP's REBEL Helicopter
Onair 1700 Sailplane

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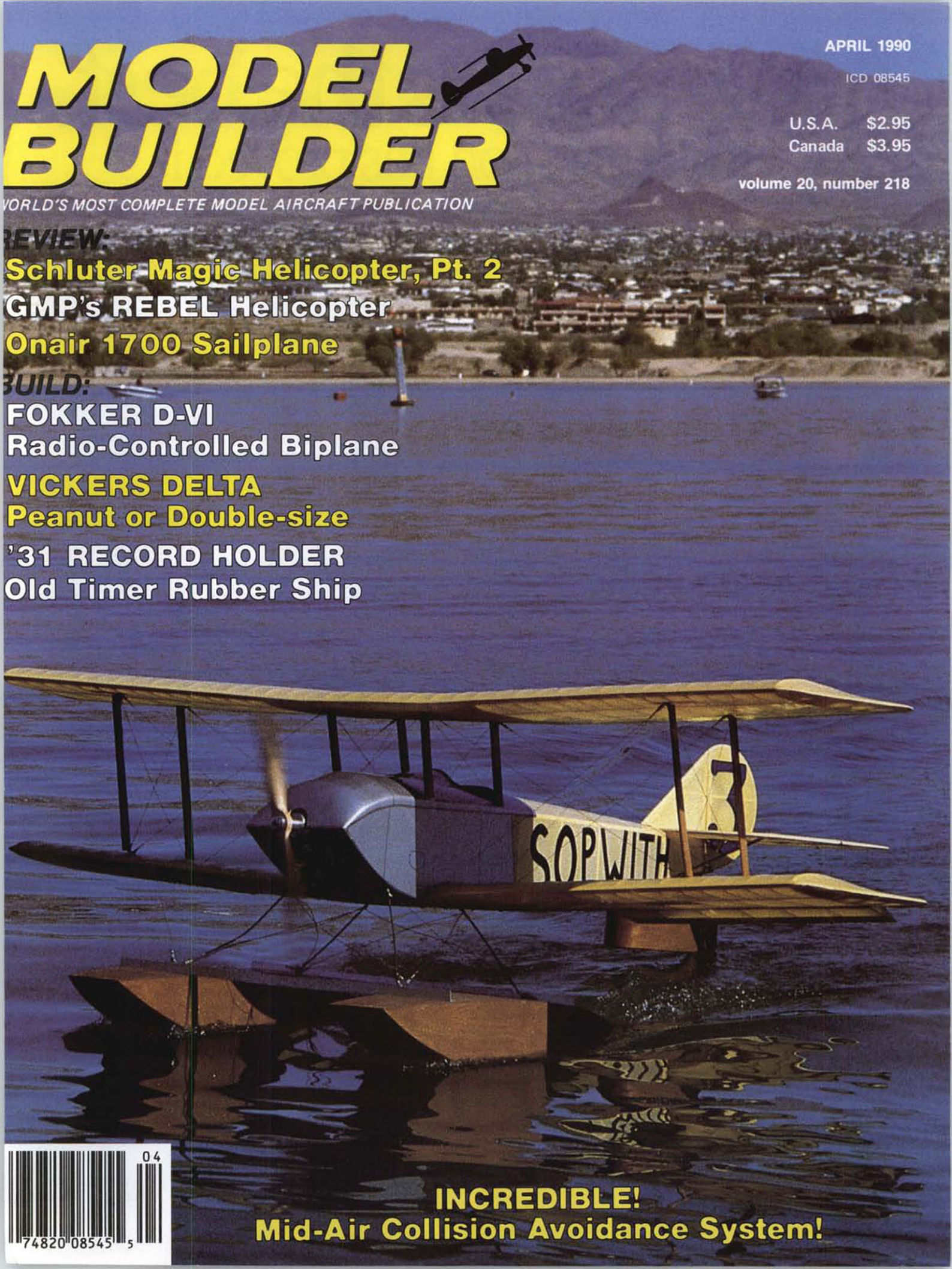
VICKERS DELTA
Peanut or Double-size
'31 RECORD HOLDER
Old Timer Rubber Ship



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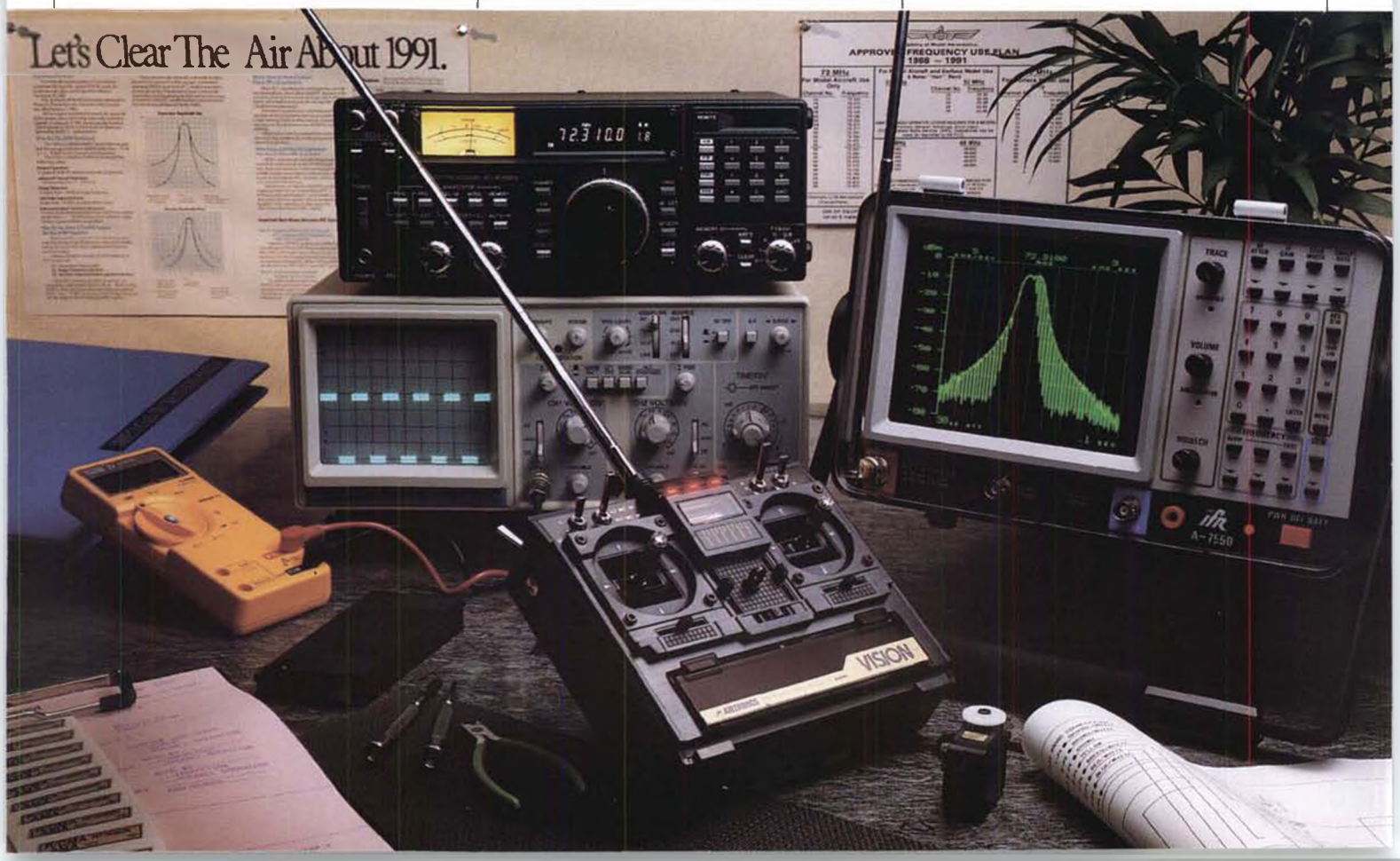

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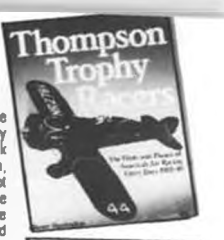

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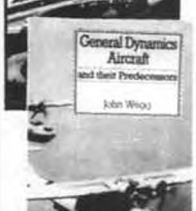

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MODEL BUILDER

APRIL 1990

volume 20, number 218

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CONTENTS

FEATURES

CONSTRUCTION

COVER: One-third scale (103-inch span) Sopwith Tabloid taxiis to the shore on Lake Havasu, Lake Havasu City, Arizona, after an official flight. Built by four members of the Quarter Scale Association of America; Harry Rader, Paul Lussier, Tom Gill, and Dave Wilms, the aircraft was flown at the now very famous Schneider Cup Re-enactment by Dave Wilms. This event was produced by Bob and Kathy Martin, with the help of many others, in November of 1989. A report, and selection of interesting photos, will appear in the next issue of *Model Builder* magazine.

MODEL BUILDER (ISSN 0194 7079) is published monthly by RCMB INC., 898 W. 16th St., Newport Beach, California 92663. Phone (714) 645-8830.
Subscriptions: $25.00 per year, $47.00 for two years. Single copies $2.95. Subscriptions outside the US (except APO & FPO) $38.00 for one year, $68.00 for two years. All payments must be in US funds, drawn on a US bank.

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from Bill Northrop's workbench

Its tail still glowing white hot from re-entry into earth's atmosphere. Skip Ruff's Martian Space Ship slows down for landing at Taft, California.

The 1990 IMS Pasadena show has come and gone, and the changes in the format seemed to have met with the approval of both the exhibitors and the attending public. The two major changes in the layout were the elimination of the indoor flying area and the exhibit booths in the long hallway connecting the two exhibit buildings. Actually, these two changes went hand-in-hand. Because of the overflowing attendance in recent years, the indoor flying had become an increasing insurance, safety, and fire department concern, and the crowded hallway was a serious threat to rapid exit in case of an emergency. Both caused bottlenecks in traffic flow that were annoying to exhibitors, spectators, and particularly the Pasadena Fire Department. Eliminating the indoor flying provided the booth space needed to make up for the loss of space in the hallway, thus solving both problems simultaneously. There were a few disgruntled spectators who wanted the flying to continue, but leveler heads understood the situation.

The other significant change was in Friday's show schedule. To ease the crowding, and because a whole day of trade-only was obviously more than necessary, Friday was split between trade and consumer. Trade-only started with the show opening an hour earlier, at 9 a.m., and ended at 2 p.m. when the doors were opened to the public. With a closing time of 7 p.m., this gave the public five additional hours for the weekend, and still allowed the exhibitors to close up and have time to eat dinner at a reasonable hour of the day.

Although it was not expected to work well the first year, advanced publicity about the new public hours on Friday obviously paid off, as a large crowd had assembled at the entrance well before 2 p.m., and the public continued to pour in and keep the exhibitors occupied until closing time. Having proved its value in Pasadena, the same three-day schedule, with Saturday and Sunday hours remaining the same as in the past, will be used at the Atlanta and the new Milwaukee IMS shows.

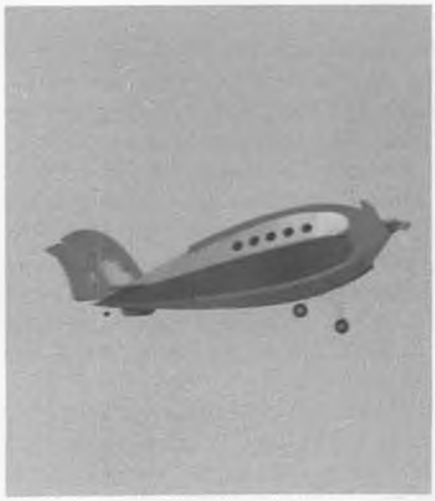
Next month's issue will feature a photo story on the 1990 Pasadena show, but we'd like to add one interesting sidelight at this point. Having always been interested in R/C scale (our first ever published construction article was for a rudder-only Great Lakes Trainer, in a 1958 issue of *American Modeler*, and believe it or not, I was the first acting chairman of the newly formed scale contest board somewhere back in the late '60's), when it came time to select certain categories in our static model competition to award R/C systems (Airtronics) to the winners, one selection was R/C Precision Scale, Military, whereas Sport Scale Military was purposely NOT selected. This was done with tongue in cheek because we have seen so many really well detailed and weathered R/C scale models entered in Sport Scale at static competitions, and we wanted to see what would happen. Well, what do you know? The Precision Scale entries outnumbered the Sport Scale entries three to one! "Nuff said."

BIG LITTLE HELI CONTEST

Translated into better English, we're trying to say that arrangements are being made for Kyosho/Hobbico and *Model Builder* magazine to co-sponsor a major helicopter competition for 30-size helicopters, June 9 and 10, 1990, and hosted by the Champaign County R/C Club of Champaign, Illinois, and to be called the First Annual Kyosho R/C Helicopter Challenge.

Why for 30s only? It is generally conceded by knowledgeable heli fliers that in all-out competition at major contests, such as world and national championships, a smaller heli is not likely to win when pitted against the 60-size choppers. Yet, based on sales figures, there are lots of 30-size helis flying around. So why not a contest just for the little guys? No sooner said than done.

This announcement is being made before all the facts have been pulled together, however, an ad appears in this issue, and will be followed by larger ads in subsequent issues, giving all the final details. At this point in time though, we can pretty safely state that this will be a fully sanc-



The R/C Space Ship is 60 inches long, "span" is 20 inches, dry weight is 2-3/4 pounds, power is an O.S. .25 and radio is three-channel. Construction article coming soon.

tioned AMA contest, based on current AMA rules for helicopter competition, with Novice, Intermediate, Scale, and FAI categories being flown by 30-size machines only . . . that is, helis that are generally recognized as 30-size, including Concept 30, Shuttle, Baron 20, Cricket, Kalt Enforcer, and X-cell 30. Of course, engines *classified* as 30-class include the Enya .35, Supertigre .34, and the O.S. .32 and .28. Trophies and merchandise awards will be awarded to the top placing fliers in each category.

Plans for the event go beyond just the contest itself. All heli manufacturers are being invited to bring their top fliers to compete and to put on demonstrations, between competition rounds, of their latest products. An onsite dinner is being planned for Saturday night. You might call the whole affair a contest/symposium.

For further information, refer to the ads, which will undoubtedly provide a phone number and address to make contact.

LITTLE DENNYPLANE FOLLOWUP

Dan Lutz, who provided the words and lines for the Lit'l Dennyplane Jr. in the January '90 issue has written in to say that he has received several nice comments on the article. He goes on to say that Freddy Bartholomew is alive and well, and now lives in Florida. Jane Withers and her family live in Fountain Valley, California (location of the legendary Mile Square Park), and are very active in the antique car hobby. Wonder if Mr. B. ever tried another model airplane?

PUBLISHER'S STATEMENT

Because of ill-conceived and inaccurate information that has recently been circulated throughout the free flight fraternity by one individual, many readers of *Model Builder*, especially those with a leaning toward indoor, have been needlessly alarmed about the magazine's policy in regard to publishing *ALL* free flight material in general.

It has always been, and will continue to be, the policy of *Model Builder* magazine to publish, at no specific intervals, material about any and all phases of free flight, control line, and radio control aircraft modeling.

OK, that's the statement. Now some additional comment. We have received a ton of mail in regard to the above-mentioned action on the part of one individual. He must have spent a fortune on postage to conduct his campaign, but aside from the fact that it was entirely unnecessary, and he was the only one to end up with egg on his face, the responses that were generated provide some interesting food for thought.

First of all, mail came from all parts of the USA, as well as from Canada, several European countries, Australia, New Zealand, and Japan. We said he spent a lot on postage! Letters came from prominent free flighters from both the contemporary years as well as from the past. One famous model designer, whose material used to appear in print as far back as the mid-thirties, wrote to us from another part of Southern California. I had no idea he was "still around," much less being only 20 to 30 miles away! It is a total thrill, and kinda haunting, to realize that someone so noteworthy from the past has just come back to model airplanes again, and considers *Model Builder* the best of the current publications! Bet I have you old-timers scratchin' your head now, don't I?

Most of the mail received has come from free flighters, as you might expect, though about 30 percent came from modelers who are now partly or totally into R/C.

About 90 percent of the letters have been concerned, friendly, and some have offered constructive criticism. Unfortunately, about 10 percent are rude, threatening, and abusive. Of course, one has to expect this. It's part of life when you deal with the public, even though you still try to maintain the thought that everyone with a common interest pulls together. Oh well, so be it.

Speaking of pulling together, there is one particular thought that we would like to pass along that all of us, no matter what facet of the model airplane hobby attracts our main interest, should keep in mind.

Somebody once said, "No man is an island." (I'd appreciate a note or call from anyone who can recall who said, or wrote it.) I believe the same observation applies to our hobby. None of the three basic types of model aircraft . . . free flight, control line, or radio control . . . is an island; nor is the modeler who specializes in any one of the three categories. There are many true modelers among us who realize that all model building has something for everyone. Free flight may have been the origin, but in all three activities, the same basic methods of construction and the same basic laws of aerodynamics must apply, across the board, if we are to be successful. We, and any facet of our hobby, are a continent . . . None of us are an island.

As a publisher and editor of what we would like to believe is a traditional model airplane magazine, we have been a close and concerned observer, as well as a participant, in a broad range of model aircraft activities, and we believe that no matter where you look, the skilled and successful modeler is the one who builds structurally sound model aircraft, from the lightest to

Continued on page 64

ADVICE FOR THE PROPWORN
—By Jake

It's time once again for "Jake's Glossary of Misunderstood Terms." Normally, the terms and definitions in the glossary are at least loosely associated with aviation, and with the model aircraft hobby in particular. Recognizing, however, that not everyone has only one hobby, and that many of you out there may be part time golfers, gardeners, or fishermen in addition to your modeling interests, this month's glossary will outstep its normal bounds and delve into the frequently misunderstood jargon from some of the other more popular hobbies. But first, and as usual, we'll start with the world of aviation.

Jake's Glossary of Misunderstood Terms
Aviation

Static Judging - Laundromat event to determine whose clothes have the most socks stuck to them.
Silk and Dope - Ernest in pantyhose.
Carburetor Icing - Chocolate frosting for your Walbro.
Spiral Dive - Sleazy bar with a fancy staircase.
Axle Grease - Teutonic hair tonic.
Perry Pumps - What Mr. Como does at a self-service gas station.
Microfiche - Guppies.
Critical Mass - Weight above which Roseanne explodes.
Barnstorming - Much worse than raining cats and dogs.
True Scale - Never found at a diet workshop.
Mineral Oil - Two things found in Tammy Faye's makeup.
Tail Dragger - Woebegone dog.
Air Brush - Similar to air guitar. Practiced by teenagers dreaming of becoming heavy metal house painters.

Continued on page 65

OVER THE COUNTER

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

What comes between a build-it-yourself, traditional model airplane kit and an Almost-Ready-to-Fly (ARF) model? An ARC! No, it's not Noah's floating motel for swinging animal couples, it's an Almost-Ready-to-Cover model airplane kit. Combining traditional model building with modern construction techniques, Altech Marketing, P.O. Box 391, Edison, NJ 08818-0391, now offers three R/C model aircraft for your fast assembly pleasure, leaving you the choice of covering and finishing materials.

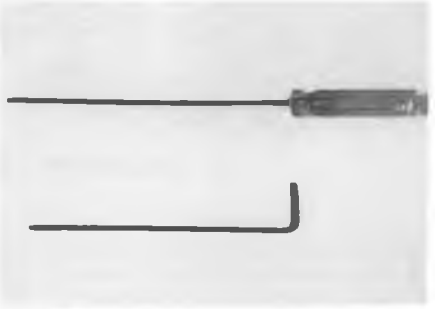
First there is the Super Stearman, which spans 54 inches and is designed for 60 to 80 two-stroke, or 60 to 90 four-stroke engines. This is the post-war, hopped up version of the famous WW-II military biplane trainer, with deeper cowling for a bigger engine, and wheel pants. The built up fuselage features laminated wood construction, and the wings are of sheeted foam core. Cowling is pre-formed, and there's a plastic hatch for access to the radio gear without removing the wings. All struts are bolted on for quick assembly and take-down at the field.

Next there is a shoulder-wing sport/trainer for the beginner who has logged a few hours of flying time and is ready to move up to more performance. The Sage 25 spans 56 inches, takes a .19 to .25 two-stroke engine, and with the use of a four-channel radio, offers aileron, elevator, rudder, and throttle control, plus steerable nose gear.

Last but not least of the new threesome from Altech is the sport scale Zlin Akrobat, offering the same sheeted foam core wings and laminated wood fuselage construction featured in the other two ARC kits. This airplane is in the 4-1/2 to 5-1/2 pound weight range, and takes a 40 two-stroke or up to a 53 four-stroke engine. As with the other ARC kits, you chose your own covering and color schemes, rather than having to go with "factory markings."

For further information on Altech Marketing's new kit line and selecting an Enya engine for power, call Gabe Mastriano at Altech, phone (201) 248-8738, and be sure to tell him we sent you!

Electric powered Fleet Model 2 from Concept Fleet.



Du-Bro's 4-40 socket-head wrenches.

* * *

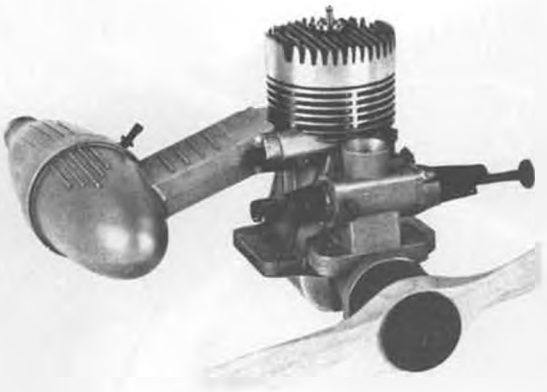
Concept Fleet (formerly Concept Models), 2906 Grandview Blvd., Madison, WI 53713, after more than ten years of producing the well-known handcrafted quarter-scale Fleet Biplane kit, is now introducing a new Fleet. This one is a 56-inch wingspan version designed around the Astro Geared 40 electric power system. With an all-up flying weight (including fuel, ha!) of 6 pounds, 9 ounces, the wing loading comes out to a very comfortable 20 oz./sq. ft., which should provide lively aerobatic performance and scale flying characteristics.

As you might suspect, the kit is produced by Romey Bukolt, who did the big Fleet, which pretty much guarantees the excellent quality to be expected. The kits are handcrafted (no die-cuts), with sawed and

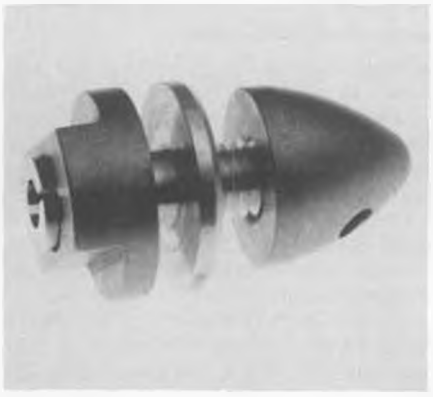
The "Bingo" from Ace R/C.

From Altech Marketing, the Zlin Akrobat.

Hand-painted pilots from Hobby Lobby.



The Fox Quickee Sport 40.



Prop shaft adaptor from Hobby Lobby.

matched wood parts cut from balsa, spruce, and plywood. Full-size plans are rolled, all wire components are pre-bent, and detailed assembly instructions include photos and illustrations. Historical data on the Fleet Model 2, including structural 3-views are also provided. Kit features scale rib spacing and fuselage structure.

This is a kit for real model builders, and for a price of under $100, even if it's only one penny under, it has to be a bargain. Ours is on order!

* * *

Boxes Plus, the assembled wood field and/or home hobby box people, at P.O. Box 521, Hubbard, OR 97032, phone (503) 982-0220, want to help you get organized with their DB-4d Field Box. It comes fully assembled, pre-sanded and ready for your paint or stain job. Overall size is 22 inches long, 10-1/2 inches wide, and 17 inches high. The large top compartment will hold bulky items (large enough to hold two 1/12 or 1/10-scale cars), and the drawers will hold radios, chargers, tools, and spare parts. You can also add the P-10 one-gallon fuel container available from Boxes Plus. The suggested retail is $84.95.

* * *

Du-Bro Products, 480 Bonner, P.O. Box 815, Wauconda, IL 60084, now offers Devcon Super Glue (C/A) in a new Push Button Applicator. The applicator controls the amount of glue to come out according to your wishes, avoiding waste. The applicator uses 2-gram cartridge refills of Devcon Super Glue. The Push Button Applicator package includes two 2-gram cartridges.

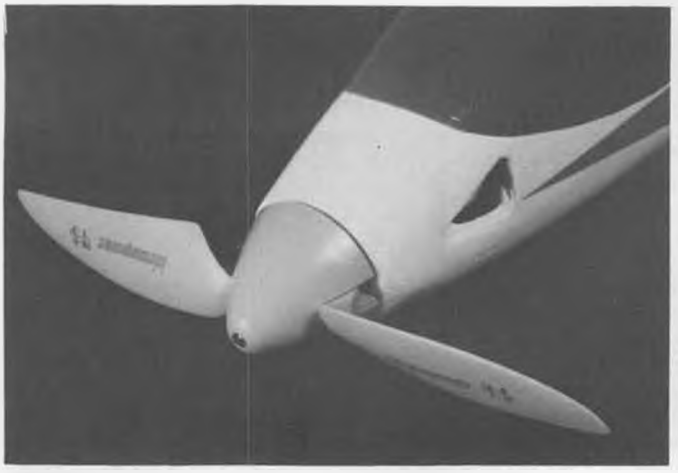
Du-Bro also offers two new wrenches to fit 4-40 socket-head screws that are included with some of its collars and other hardware. One wrench is L-shaped like a typical Allen tool, and the other has a plastic handle. See these items at your dealer, or if you have questions, call Jim Broberg at (708) 526-2136. Tell him we sent ya.

* * *

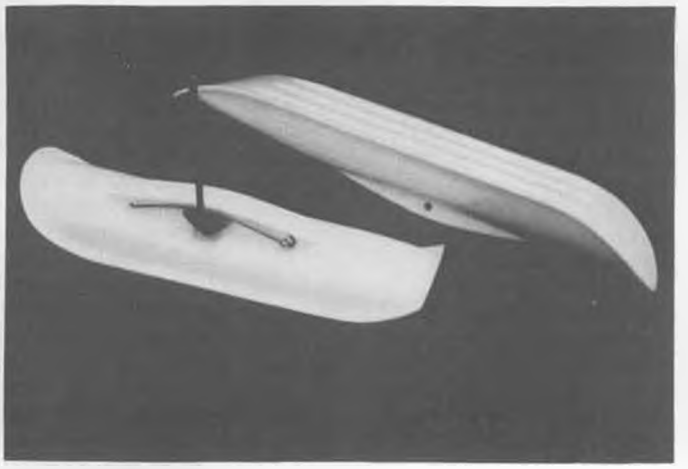
Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820, phone (217) 398-6300, offers a whole selection of blades . . . but they don't fit in any model

Z-Poxy finishing resin from Pacer Tech.

knife handles . . . and all they cut is air! Yeah, you already saw the picture . . . they're Kyosho helicopter blades! There are Deluxe Weighted Wood Blades, Expert Wood, Sport Wood, and Pro Main Blades, plus a blade case, and One-Piece Tail Blades. Other helicopter parts available from Great Planes for upgrading the Kyosho Concept 30 include S.E. Stabilizer Blades, a Mixing Lever Set, Mixer Lever Bearings, Shaft Guide, Pitch Slider Set, Pitch Slider Bearings, and Stabilizer Seesaw



Graupner Scimitar folding props from Hobby Lobby.



Beckman Snow Skis from Hobby Lobby.

Graupner ASW 22B(E) from Hobby Lobby.

ET 200 completely built sailplane from Hobby Lobby.

Bearings. These parts are for hopping up the standard DX heli to an SE, and are not recommended for beginners.

* * *

Hobby Lobby International, Inc., 5614 Franklin Pike Circle, Brentwood, TN 37027, importers of many fine model products, especially from Graupner of West Germany, has a whole bunch of new items that appear in their latest catalog, Number 15, which is free for the asking. Write or call (615) 373-1444, and tell 'em we sent ya. Here are a few things picked out of the new catalog.

The Graupner Ventus C Sailplane is for both slope and thermal soaring. With the plug-in wing extensions, the span is 147 inches, which makes it great on those low lift days. It has an epoxyglas fuselage and balsa sheeted foam wings with ready-cut recesses for ailerons and spoilers.

The Power Gear 2.5 is a 2.5-to-1 belt drive reduction system mounted and ready to receive an inexpensive ferrite magnet electric motor of the "540" standard size, to power airplanes up to 60-inch span, or gliders up to ten foot span. It has two ball bearings, a reinforced belt, a 5mm shaft, and simple mounting system. A Prop Shaft Adapter for mounting non-folding props is shown in a separate photo.

The GT 300 Electric Aircraft Motors now come in five different voltages, so you can fly almost any sport airplane in the .25 to .40 glow engine categories. The higher voltage motors require more NiCd cells and run longer. Or, you can apply high voltages to the lower voltage GT 300 motors to get shorter runs of extreme high power, as needed for electric sailplane competitions. These motors feature the new neodym barium ferrite magnets, which are stronger than samarium cobalts.

Hobby Lobby is importing a variety of Hand-Painted Pilot Heads to fit different sizes of model aircraft. These are made in France and painted in fine detail.

In some parts of the world, Beckman's Aircraft Snow Skis are still in season as you first read this! These are plastic, with internal wood bracing, and have spring blocks that hold them in a slightly nose-high attitude so your model won't stub its toe as it lands. They'll also work fine on wet grass. The sizes range from 6, 7, and 8-inch for nose gear or tail, up to 9-1/2, 10-1/2, and 11-1/2 for main gears, all for 60 to 80-inch span aircraft.

Guess what? We just found the 44-inch

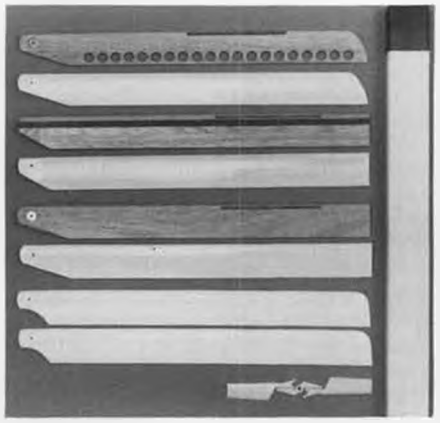
Prop couplers and cones from Hobby Lobby.

Graupner Ventus C Sailplane, Hobby Lobby.

Super Glue and applicator from Du-Bro.

Power Gear for electric motors, Hobby Lobby.

Field/home model box from Boxes Plus.



Kyosho heli blades. Great Planes Model Dist.

Quarter-scale floats for Husky and other aircraft, from Byron Originals.

floats our editor/publisher has been looking for. They're on page 78, with the skis, in the same Hobby Lobby catalog! How about that?

Judged "Most Impressive Electric Airplane" at the well-known KRC Electric Meet in September 1989, the Graupner ASW 22 B(E) is an electric boosted 3-meter sailplane with fiberglass fuselage and foam/balsa wings. At KRC, it was powered by a Graupner Ultra 1600 motor, turning a large Scimitar prop, also from Graupner.

Speaking of Graupner Scimitar Props, these folding electric props are available in five diameters, including 6x6, 7x3, 8x4-1/2, 10x6 and 11x7. Check shaft diameters when ordering . . . most are for 5mm shafts, some also available for 1/8 (3.2mm) shafts. Prop couplers and cones are also available for adapting to other shaft sizes.

The ET 200 is a completely built sailplane for electric flight. It has a 78-inch wingspan and uses the same Graupner sailplane drive systems (motor and Scimitar prop) that are used in the Elektro-UHU. Great for the novice.

One more comment on Hobby Lobby. Be sure to order the free catalog. It has more variety of modeling items than anything we've seen in a long time. Be sure to look them up at the various trade shows around the country so you can see the products first hand. Fortunately, the catalog is well illustrated, with many items shown in full color.

* * *

Bingo! Heck of a name for a new four-channel, low wing sport model from Ace R/C. The Bingo, designed by Doc Mathews for .40 to .60 two-cycle or .48 to .90 four-cycle engines, has this broad power range by virtue of its choice of wingspan . . . either 70 inches or 58-½ inches, depending on engine size used. Construction is conventional lite-ply fuselage sides with

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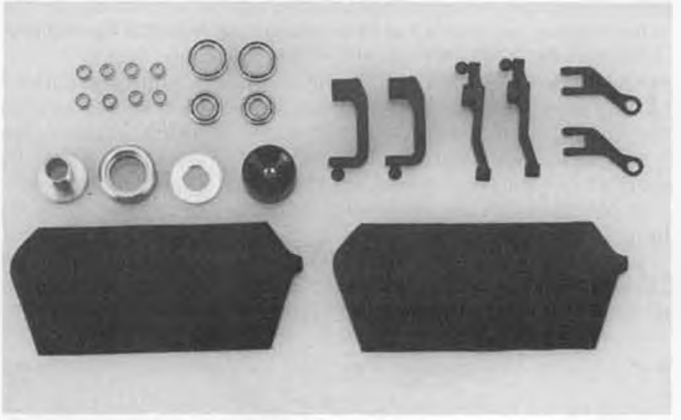
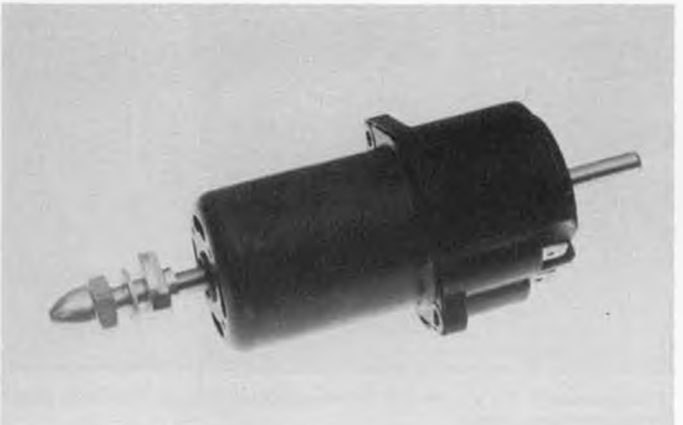
Super Stearman from Altech Marketing.



Kyosho Concept 30 upgrade parts from Great Planes Model Dist.

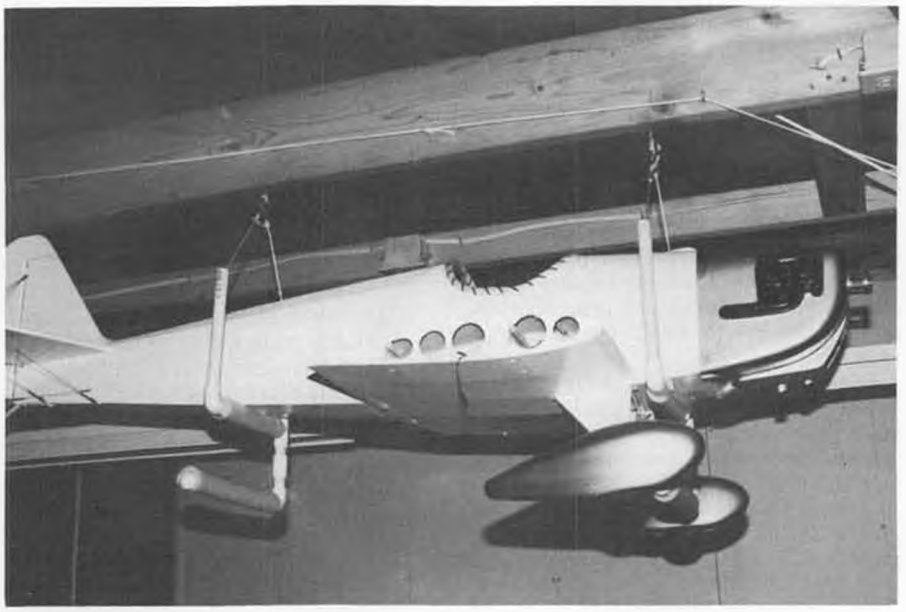
The Sage 25 sport/trainer from Altech Marketing.



GT 300 neodym barium ferrite magnet motors from Hobby Lobby.

BIG BIRDS

By AL ALMAN



Standardizing on hangers has its drawbacks too. Note that Spacewalker landing gear blocks the lower rack that's supposed to carry wings.

The longer we stay in R/C the more airplanes we're prone to accumulate. This usually happens because:

1) Our flying skills gradually improve so we dork or totally destroy fewer airplanes;

2) We tend to hang on to more of these long-lived aircraft.

Like everyone else I also keep the planes I like (the problem is that I seem to like all of them). True, only a few of my birds are pristine and some might even be considered to be "eyesores" by those who are professional nit-pickers . . . but all of them are still in dandy flying shape.

During my recent move I unearthed even more flying machine parts and pieces that'd been stuffed into long forgotten nooks and crannies. As a result I faced the problem of what to with one helluva lot of aeroplanes when my new shop was built.

Now you'd think that 576 square feet would provide plenty of room for airplane storage in addition to an adequate work area. Well, it probably would if the walls were left bare to hang the planes on . . . but I got into a frenzy and festooned the walls with shelving.

Which left me with only one thing to do with my birds . . . hang 'em from the rafters and/or the joists. But the BIG question was . . . how? I always try to keep things basic and therefore fully subscribe to the KISS (Keep It Simple, Stupid) principle. However, the most simple approach, using slings, had little appeal mainly because the (rope) slings could crunch or crush the fuselages.

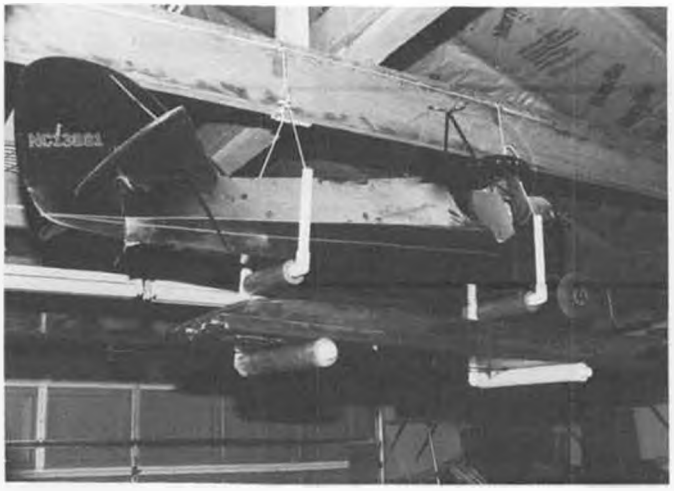
Help in the form of a few ideas and sketches for hangers came from look-a-like, Fritz Bruning, who seems to have a way with things mechanical. Since he's also a KISS devotee, it's not surprising that the ubiquitous PVC pipe headed his list of materials.

As you can see from the drawings and photos, these PVC hangers are quite simple, yet effective. I decided to standardize the dimensions to accommodate my largest and widest fuselage and made all the hangers the same size. This minimized time and effort by keeping the project uncomplicated.

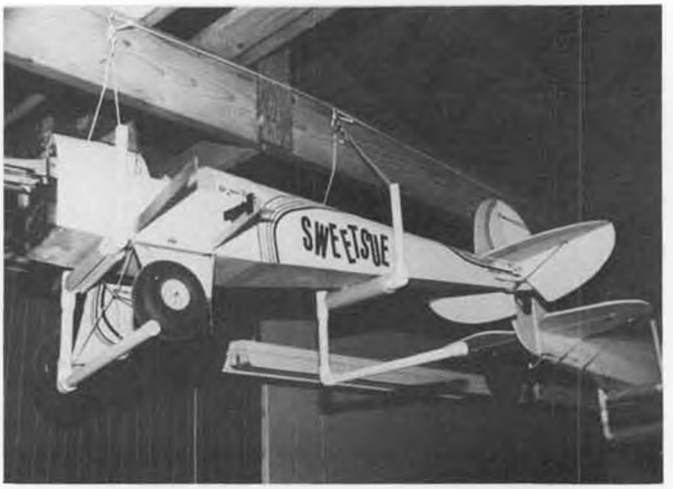
The hangers are made from 1/2-inch white PVC pipe and the rope going through each U-shaped hanger is 3/16-inch nylon. Its ends are tied to one-inch "S" hooks which, in turn, are connected to a one-inch ring tied to the end of long pieces of the nylon rope that the planes actually hang from . . . and these are routed through medium screw eyes and secured to cleats nailed to the wall.

And not to worry that these nylon rope knots will slip and come apart. All you gotta do is squeeze a few drops of regular (thin) Hot Stuff on each knot; it makes 'em PERMANENT.

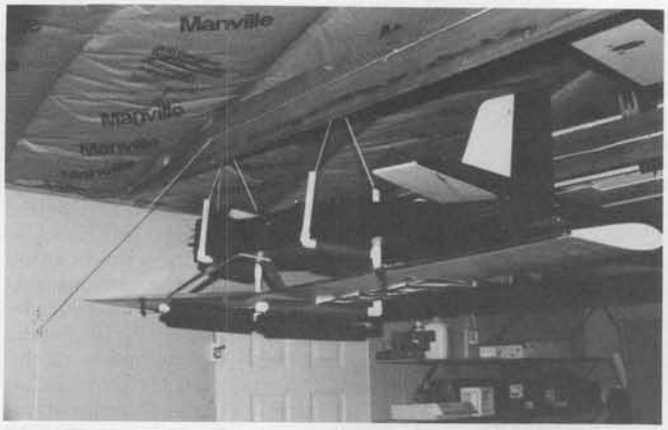
Initially I was planning to use small turnbuckles and swivel-snaps in this system but, because I was able to save bucks without sacrificing strength or integrity, I used the screw eyes instead of turnbuckles and "S" hooks in place of swivel-snaps. I realize there'd be less wear and tear on the nylon

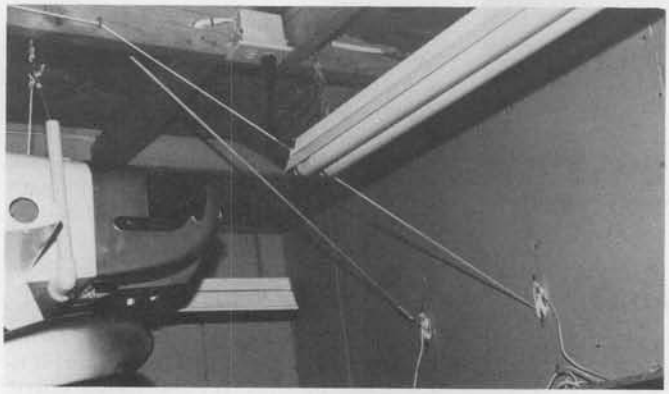


The Aeronca C-3 is a perfect fit for standardized hanger, with both wing halves on lower rack.

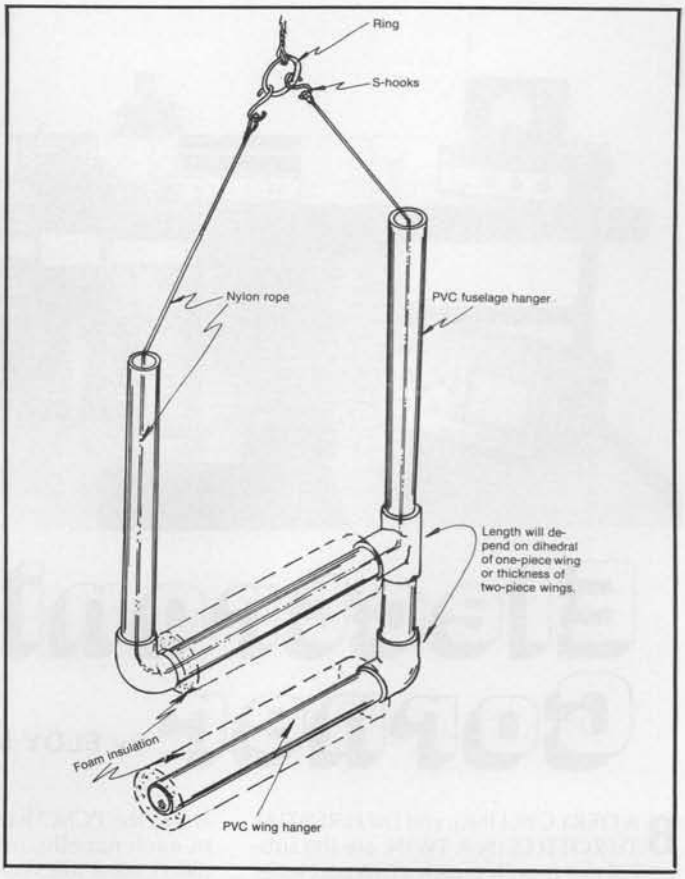


"Sweetsue" (Wimpy) wings also had to go elsewhere. Extending vertical strut to lower rack might solve problem.





The 3/16-inch nylon rope is tied to cleats that are nailed to wall. Pulleys not really needed because of limited use.



rope if turnbuckles were used, but since the rope is quite stout and the planes won't be hauled up and down daily, the lack of turnbuckles should not be a problem.

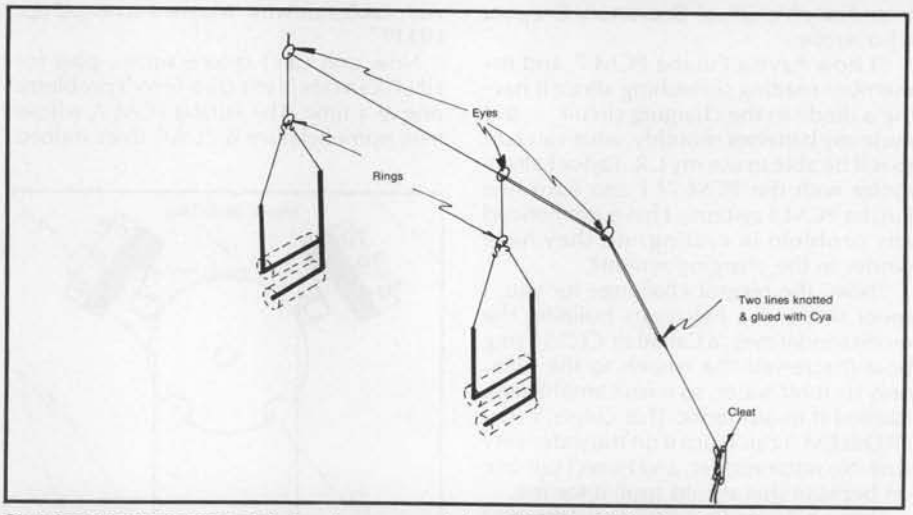
Anyhooo . . . this is how I stored my BIG Birds. Of course none of these ideas are absolute and just about everything can be changed or tailored to suit your particular needs or situation. I may very well change or modify my setup as better ideas come along.

HALF SCALE RACING ASSOCIATION

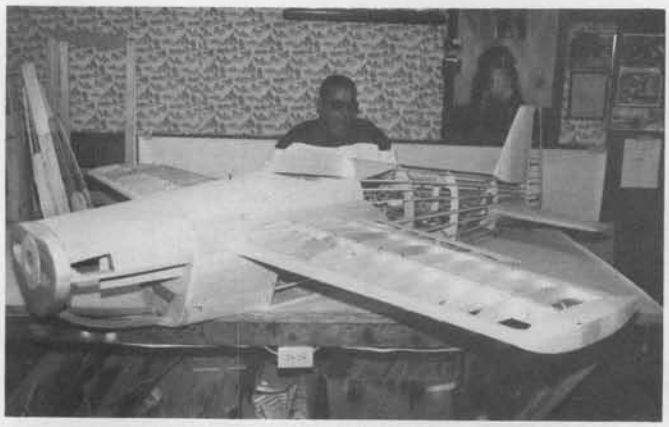
At first I wasn't too sure about "Crash" Evanson.

Y'see, he's line chief at St. Paul's International Airport and it's difficult to take anyone who enjoys a minus 70 degree chill factor very seriously (up here, in Washington's Puget Sound area, our winter weather

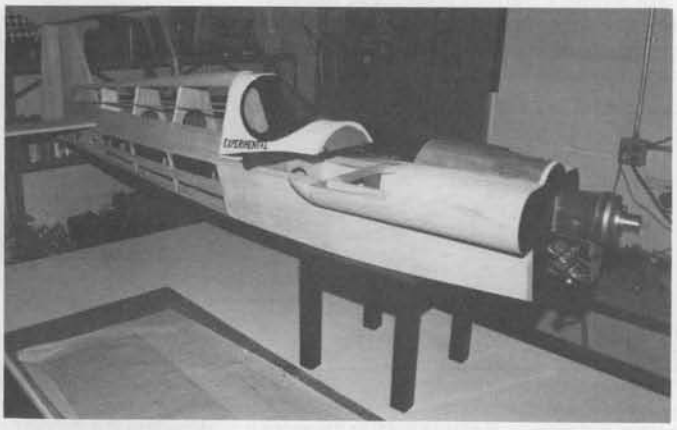
Continued on page 70



Sketches showing proposed airplane hangers made from PVC pipe. Notice insulation foam is used to cushion fuselage and wings.



Bob Pokorny is kinda dwarfed by his framed-up 50 percent Pogo. Half-scale pylon racing sounds like fun!



"Crash" Evanson's half-scale Cassutt fuselage with big Sachs up front. Half Scale Racing Assoc. is his idea.

Electronics Corner

By ELOY MAREZ

BATTERY CYCLING, and DIFFERENTIAL THROTTLES IN A TWIN, are the subjects of this month's mail, a two part letter from Terry McGill, oF Beaverton, Oregon, who wrote:

"I now have a Futaba PCM 7, and remember reading something about it having a diode in the charging circuit . . . as I cycle my batteries monthly, what can I do to still be able to use my L.R. Taylor battery cycler with the PCM 7? I also have two Futaba PCM 5 systems, I have not noticed any problem in cycling; do they have diodes in the charging system?

"Now, the biggest challenge for you. I spent five and a half years building the nicest model ever, a Canadair CL215 flying boat (I screwed the wheels to the sides, only fly it off water, so it isn't amphibian). Painted it in authentic Thai colors, even. PROBLEM: I can't turn it on the water very well. No water rudder, and I won't put one on because that would spoil it for me.

"Now, how can I get differential throttle? I bought the PCM 7 so that I could dial my flaps where I wanted them, and still have an extra channel or two to computer-hook up the throttles. I find that I'm either too dumb or I can't do it with what computer ability the PCM 7 has. NOTE: I have servos in each nacelle, one for each motor. I didn't want the slop of cables or fiddling with cables or wire. Maybe I screwed up. HELP?"

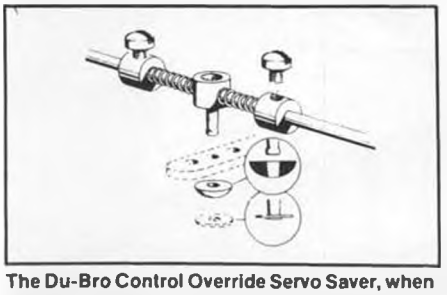
Now one can't ignore such a plea for HELP, can one? Let's take Terry's problems one at a time. The Futaba PCM 7, whose true nomenclature is 7UAP, does indeed include a blocking diode in the charging circuit, which prevents the battery voltage from being present at the charge jack, and also prevents the use of battery discharge or battery testing devices. I don't understand the logic back of this, unless it is to prevent the oft seen damage caused by short circuits made while these external test instruments are in use. This could be an acceptable explanation for the inclusion of this diode, however the obvious next question is that if it is such a great idea, why is this diode not included in all Futaba transmitters? With the exception of the 5UA family, such circuitry is not found in any other current Futaba equipment, including the top-of-the-line nine channel systems.

Oh well, ours is not to reason why. . . . What to do about it? There are two possible solutions, one being simply to remove the battery for testing, making the necessary connections with alligator clips, or making up a wiring harness using a Radio Shack No. 270-325 connector, which mates with the connectors on the transmitter battery pack. Polarity is important, so be sure that you check everything thoroughly before your final connections and any charge/discharge tests are made.

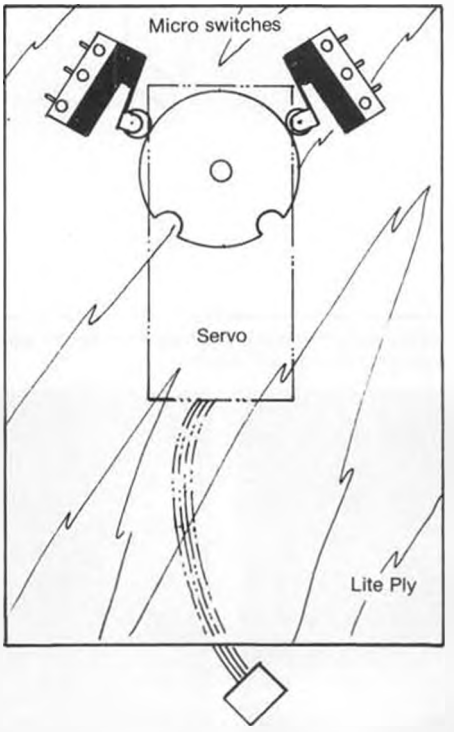
The other solution is to go into the transmitter and jumper the diode! It is located on a small printed circuit board immediately under the charge jack, and is connected to its positive (center) contact. You can remove it if you like and install a short length of wires in its place, or you can simply add the wire across it, on either side of the board. You can then do all of your battery testing directly from the charge connector as in the past.

Now the question arises as to why our web-footed friend is able to test his five

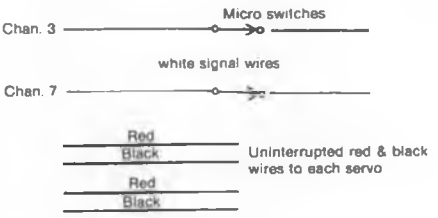
Continued on page 65



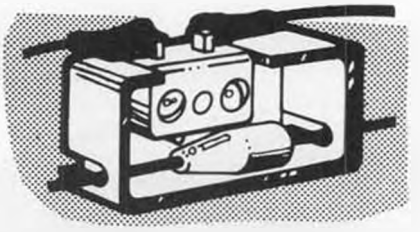
The Du-Bro Control Override Servo Saver, when properly adjusted, allows normal positive pushrod action, but relieves pressure back to the servo if movement is restricted. Recommended for engine control described.



Method of mounting servo-actuated micro switches for engine control system. As the servo wheel rotates, the roller on the switch lever will drop into the depression, actuating the switch. Same arrangement can be used with one switch for other applications.



Wiring diagram for engine control system described in text. Two normally closed micro switches are wired into the servo control pulse wire; as the switch is opened, that servo stops working and throttle lever will operate only the remaining servo.



The Ace R/C Switch Box, recommended for use on one of the engine control methods described, is a simple but effective way of mounting and actuating a switch with a servo.

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PART II
Schluter MAGIC
Futaba 9ch 1024
Enya 60XF-4H

By JAMES WANG

The author's Magic with canopy/fuselage painted by Ray St. Onge, of Hybrid Hobby Mfg. Note the deformed area caused by the heat of the muffler.

• Last month we pointed out the outstanding features of the Schluter Magic and the Futaba 9VHP radio. This month we will finish up with our flying impressions. We will also let you in on how we set up our Magic and the Futaba programmable radio, so you can use them as a guideline.

If we were to choose one adjective to describe the Magic flying qualities, we would pick "smooooth." In forward flight, there is almost no tendency to balloon up or porpoise. This means the phugoid mode is very well damped. There is plenty of longitudinal and lateral stability. The vehicle damping is very high, and the angle-of-attack instability is lowered to a minimum. These are the inherent traits of a good handling helicopter. (Stability theory was discussed in August, '89 *MB*.) Military spends big bucks to design full-size helicopters with such qualities.

I did replace the smaller horizontal stabilizer with a set of larger white paddles. The kit only comes with one set of large white paddles; I suggest that you buy an extra set for the tail. In the August, 1989 issue we discussed that forward flight stability on most helicopters can be improved with a slightly larger horizontal tail. Why not give it a try? The Magic's horizontal stabilizer is made from two Hiller paddles bolted onto a 4mm stud. This permits the stabilizer incidence to be adjusted easily (I am not sure if Schluter had this intention in mind). While instructions for all the helicopters on the market, and the Magic too, say to set the horizontal stabilizers at 0° incidence, I set mine at +2°. This is like adding a slight down elevator, which helps keep the model straight and level in high speed forward flight. The drawback is it would be at the wrong angle for inverted flight.

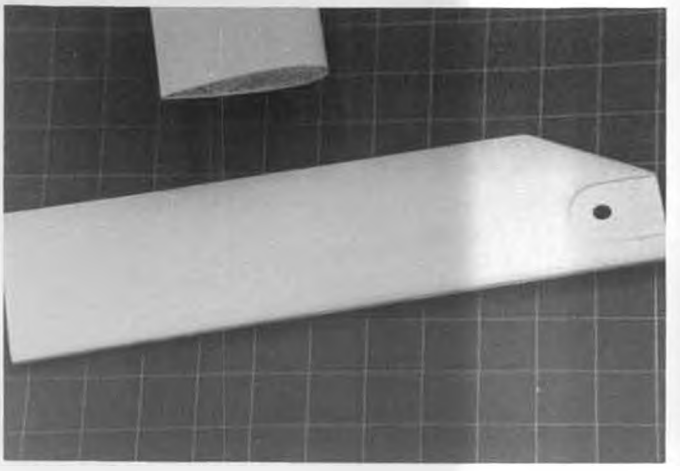
My Magic was very stable in hover and forward flight. The control feel is very smooth. I have my cyclic controls and tail rotor controls maxed out, but there is very little tendency to get into P.I.O. (pilot induced oscillations). The machine does not respond in any jerkish manner. Even a full cyclic stick movement produces a smooth transient response. The transient is smooth, then the model gets into a nice roll rate or pitch rate. Both longitudinal and lateral cyclics were set at 16% exponential on my Futaba 9VHP. The tail rotor control is set at 20% exponential. Full stick movement produces over 30° of Hiller control paddle movement, each way. I use the large, and thin profile white paddles. There is enough control authority to do a 20 foot diameter loop, and a standing roll from hover. Yes, it was tried on the Magic on the fourth flight without any hesitation.

The first three flights were just hovering and steady forward flight to break in the Enya 60X. On the fourth flight, I flew it around and started to do Banzai runs. My friend, Peter Cook (an excellent 19 year-old pilot with snakelike reflex), saw that I was having so much fun, he wanted to fly. He took over the transmitter. After about 30 seconds, he said, "This thing is smooth, and has lots of response." The next thing we saw was a hovering roll at less than 100 ft. altitude, followed by a hovering loop. Then an outside loop, and some other unnamed tumbling routines. Was I worried? Naaaa! That's what flight test is all about, right folks? We push it to the limit of the flight boundary for the review, so you know what the limit is.

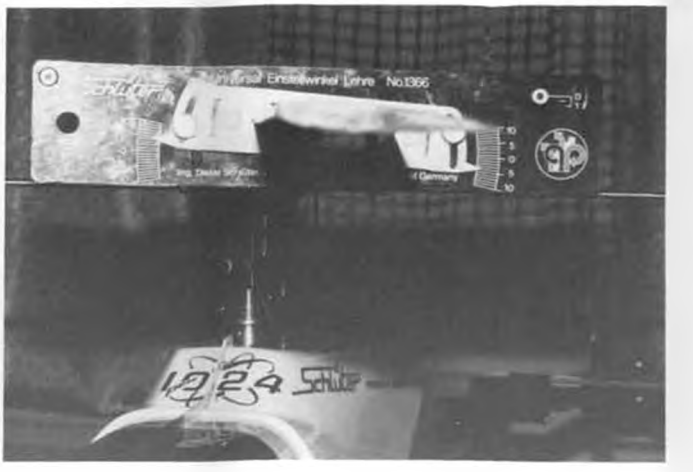
This was only the fourth flight, the engine was not even broken in yet. Every time we went to full collective, the engine

Here's looking at you, kid! Very wide stance on landing gear. Strong vertical fin with integral wire tail skid, one of the best.

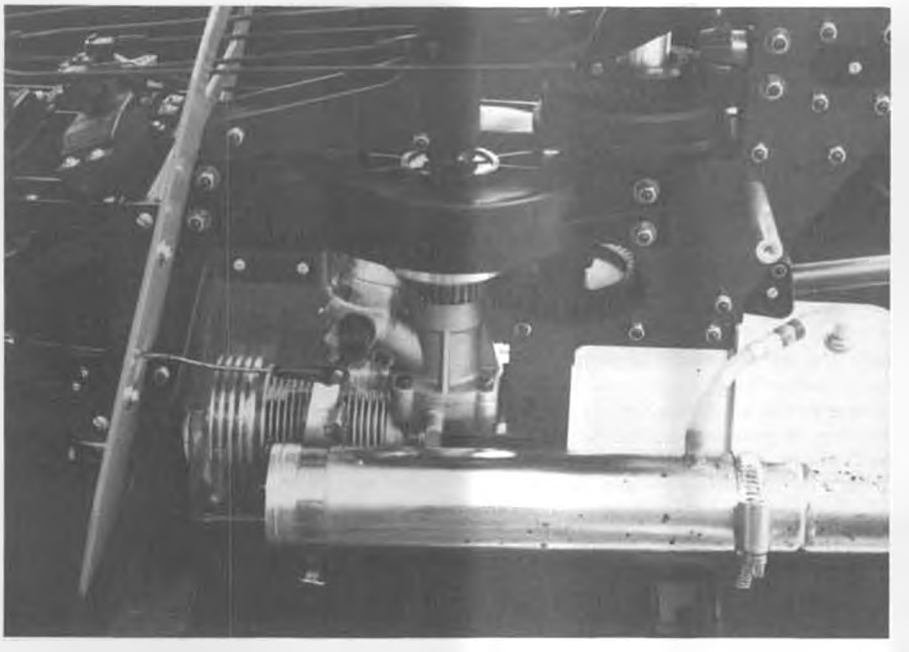
David Ramsey's Magic. Very fuidic paint job. The Magic does not fly fast, but it is smooth, responsive, and aerobatic.



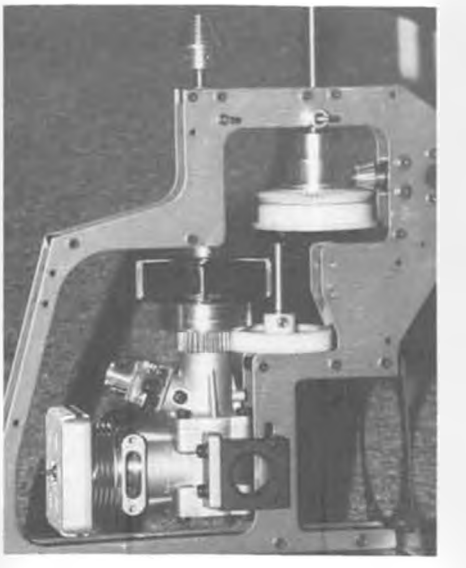
Robbe's fiberglass tail rotor blades. End view shows high density foam filling.



Schluter pitch gauge is used to set the main rotor blade pitch. Very useful tool the author has used for the past six years.



David Ramsey's Magic with stock rocking servo control system. Because of spring-loaded start system, there is no starting shaft connected to engine. Engine can be removed in five minutes.

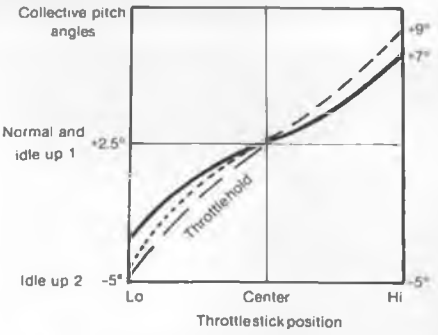


Enya 60X. Clutch mounted on engine shaft. Two-stage gear reduction transmission similar to Heim's. Top, second stage, is planetary bell housing gear. Has steel pinion gear running on inside. Shiney aluminum collar above planetary gear is driven tail rotor system.

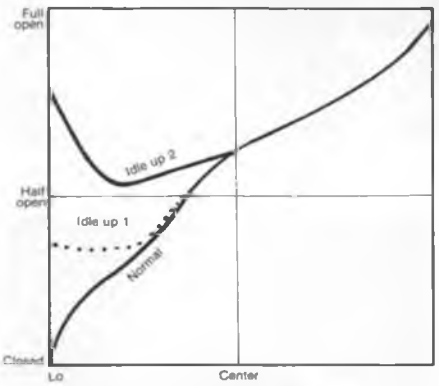
would bog down. To prevent the engine from sagging, we had to reduce the top end pitch to 6.5°. This gives a nice, healthy main rotor rpm between 1700 and 1750. To get a 1700-1750 rpm for hover, the blade pitch had to be reduced to 2.5°. The low end was kept at -5°, which gives very good autorotation performance with weighted blades. The stock blades that came with the kit are non-weighted. They only weigh about 150 grams each. That was just sufficient to do an auto, but without much in reserve.

Due to the large gear ratio (10:1), at 1700 main rotor rpm, the engine is turning at 17,000. Modern Schnuerle engines operate best at this rpm. Large gear ratio also means the collective transient response is very good. The helicopter has excellent vertical pickup. It's like driving in second gear. Combined with the large rotor diameter, 58.7 inches, punching the collective in hover will give instant acceleration. However, the steady state vertical climb rate and the steady state forward flight speed is not that fast. We estimate the forward flight

Like Champion and Scout, Magic has 20-minute fuel tank. Air hogs love it! Magic designed for Schluter's own 924 silencer system. Adjustable incidence horizontal tail. Under-slung flyboy. 58.7-inch main rotor diameter.



Pitch curves on Futaba 9VHP for the Magic



Throttle curves on Futaba 9VHP for the Magic

Author's Schluter Magic in very stable hover. Head speed is 1700 rpm. At 10 pounds, 6 ounces, it is still very nimble. Note canopy/fuselage cut away to clear muffler. Sixty hours to build and paint.

speed is at 55 mph. Maybe after the Enya 60X is completely broken in, then the top speed will improve. We have radared typical X-Cells doing 60-65 mph with a Magna piped 60, and the Legends doing 65 to 70 mph with a Magna pipe. So the Magic is slower. But the Schluter cousin, Scout 60, is also not known to be fast.

The Magic is not that heavy, but not that light, either. Mine weighs 10 pounds and 6 ounces without fuel. It has six servos (four used for CCPM, one for tail rotor, and one for throttle). A typical GMP King Cobra, or X-Cell, weighs around 10 pounds even. The Magic is slower because the canopy is significantly larger. It has more wetted area, which generates more profile and parasite drag. When the model is in high-speed forward flight, it typically tilts the nose down at 20°. In this position, the entire top surface of the canopy is causing a flat plate drag. But even with a slow forward flight speed, we were able to loop and roll this helicopter at will from any position. This is partly because I have the controls maxed out. The other reason is that high rotor rpm, wide-chord blade, and large rotor diameter increases the aerodynamic control forces generated. It is amazing that such a large, and slightly on the heavy side helicopter can be so nimble.

Our *MB* flight test team (l to r): Kelvin Phoon, Jim O'Brien, Dan Clemens, Gary Frank, and Peter Cook on the sticks. James, who took photo, is number six. What's that white stuff on the ground?

The tail rotor response is precise and perfect, not too fast, and not too slow. I have my tail rotor linkage on the fourth hole on the Futaba servo arm. At the tail rotor gear box end, the linkage is connected to the middle hole. This gives maximum amount of tail rotor command. Any more throw would cause binding. A Futaba 153BB gyro was used. The 153 has in-flight selectable high or low rate gyro sensitivity. The low rate was set at 30%. The high rate was set at 50%. I typically hover and fly at 30%, this gives a very fast pirouette rate. At 50% gyro rate, the model would just sit there. For beginners and intermediates, the gyro can be increased up to 70% without causing tail hunting.

Similar to the X-Cell, the Magic also has a teetering tail rotor design. The X-Cell has a 45° offset of the teetering pin to achieve a 45° Delta-3 angle. The Magic teetering pin is perpendicular to the blade feathering axis. It seems like there is no Delta-3, but upon examining closely, the tail blade pitch control brass ball is not in the same line as the pivot pin. As I have shown the readers how to add Delta-3 in issue 3 of the *International Helicopter* magazine, this offset ball technique introduces about 20° of Delta-3. Does this contribute to the smooth tail rotor response? Maybe not significantly. Delta-3 has more effect for the main rotor. But it definitely reduces the tail rotor hub stress. I suspect the silky tail rotor control is due to the slick ballraced sliding sleeve pitch control mechanism, plus, the tail blade holders are supported on one radial bearing and one thrust bearing. The entire pitch change mechanism is flawless! There is absolutely no slop. An A+ right here.

The tail rotor drive wire is a healthy 2mm piano wire running inside a brass tube. The brass tube is installed inside the tail boom by the factory. The 2mm wire is also flattened at the ends by the factory. Well done. The best part is that the wire is pre-cut to a perfect length! On some other model kits, the tail drive wire has to be trial fitted by the builder, and cut to proper length. Jimmy Channy, in Atlanta, Georgia, says he has radio problems with his Magic. Could it be due to the steel wire running inside a

brass tube? David Ramsey, in New Jersey, replaced his brass tube with a plastic tube from day one. Well, I use the stock tail boom with the brass tube and have no radio problems at all. Jimmy used a Futaba 7UHP. I use a Futaba 9VHP. They are both modern radios. I suspect the brass tube is not the source. I have flown GMP Cobra, and Competitor with the brass tube and never had radio problem. Jimmy, check your gyro. Maybe the RF noise-reducing capacitor on your gyro motor has fallen off from vibration, or you have some metal-to-metal contact noise. I also use a GMP base-loaded receiver with the Futaba and have no radio range problem. In fact, Steve Helms, at Futaba, once told me that he recommends a shortened base-loaded receiver antenna, because it is a lot better than having a long receiver wire antenna attached to the tail fin which makes the antenna too close to the metal tail boom.

Another fellow called and asked why his Magic tail boom vibrates slightly up and down. Well, mine does slightly, too. My fuel tank foams, too. I believe mine is because the engine fan/flywheel assembly is not dialed in. As shown in the photo and explained last month, the Magic has a new spring-loaded starting system. The engine starting cone and shaft only engages the flywheel when the electric starter is pressed down onto the starting shaft. The aluminum flywheel has two cross cuts to engage the starting shaft pin. As the flywheel is embedded in the cooling fan, the conventional dial indicator cannot be used to align the fan assembly. You may try to dial the inside surface of the flywheel, but the two cross cut grooves make it difficult. Therefore, neither David nor I dialed in our engine. His runs very smoothly, Mine runs OK. The suggestion is that if you are not satisfied with the vibration level, then just remove the engine, loosen the fan, and redo it.

Ideally, you should only use a 60-size helicopter engine with an 8mm or a 9.5mm crankshaft. The Magic flywheel is designed for these two crankshaft diameters only. In Europe, helicopter engines come with these two crankshaft diameters. The standard OS and Enya helicopter engines that you find in America have a smaller crankshaft. Rave's R/C imports from Europe a special crankshaft for Enya and OS that has an 8mm shaft. He sells the crankshaft alone for about $50, and he also carries the 8mm shaft OS and Enya engines. Rave's number is (800) 521-2511.

David played around with different combinations of the collars supplied in the kit and somehow made his OS 60 fit the flywheel perfectly. I also played around with different collars and added a rubber tube from a Sullivan nylon pushrod package and made the flywheel fit. As the fits are not ideal, make sure you add a star washer between the engine nut and the flywheel. Then add some Locktite, and really torque down the engine nut. Otherwise the engine nut will come loose by itself.

If you examine the picture of the Magic transmission and control system, you might recognize that they resemble the proven German Graupner/Heim model helicopter mechanics. Both have the centrifugal clutch mounted on the engine shaft. Both have a two-stage reduction transmission with a planetary gear unit. The swashplate on both is supported by four points, and the same anti-rotation bracket. The mixing arms look the same, and the Bell-Hiller mixing methods are identical. The only difference is that the Magic swashplate is rotated 45°, but the principles are the same. The only reason for rotating the swashplate on the Scout, Junior, and Magic is to keep the four control bellcranks outside of the side frames for easy access. It's not done for aerodynamic or dynamic reasons as you may have heard from other sources. The Schluter Champion does not have a 45° rotated swashplate, so two of the bellcranks have to go through the fuselage side frames. If you look at a Champion, you will understand what I am saying. The Magic has a clockwise rotation main rotor. The Heim has a counterclockwise rotation main rotor because its engine is mounted upside down.

On my Magic, I installed the optional driven tail rotor system. On the third flight it almost scared the living daylights out of me! After five minutes of flying, the engine went lean and started to sag and surge. This happened in forward flight. Without the driven tail rotor gear, it probably wouldn't be so bad. You can always pilot the ship back even with the engine surging and dying because the main rotor rpm will

Continued on page 74

ELECTRIC POWER

By MITCH POLING

The Grunstadt meet is in the heart of the wine country, and is one of the larger meets in Germany. It was held this year on October 7 and 8, and featured scale, pylon racing, pattern, and powered glider (duration). There were 65 entries in the seven-cell pylon racing! This racing is very fast, with planes like the Detweiler Race Cat dominating (the Graupner Race Rat is similar). The flying field is on top of a mountain, with spectacular views over rolling country. This is one of the most beautiful flying sites I have seen. In addition to all the activities, a pavilion had wurst, beer, wines schnitzel, and pastries. Needless to say, both Andrew (my three year old son) and I had fun! I missed the first day due to automobile problems, but I did get to see quite a lot on Sunday. I didn't try to keep track of how the contests went, instead I will describe some things that struck my interest.

Many of the electrogliders in the F3E class had removable nose sections with a battery cradle, as the photo shows. This is a very handy way to make everything completely accessible, including a quick change of battery packs. The throttle is also included in the nose module, just in front of the battery packs. That is daring! A camera tripod with a cradle completes the picture, as shown, for even more convenience. The cradle is made of fiberglass molded to fit the fuselage.

Another interesting item was Fredrik von der Lancken's solar charging panel for 12-volt batteries. This can keep your charger battery ready to go. Fredrik says it will charge at .5 to .75 amps in overcast weather, and up to 1.5 amps in bright sun. This works out to roughly one hour of sun charging required per charge in the plane, depending on the light conditions. Fredrik has integrated the panel into a very nice field table, as seen in the photo, with an internal storage compartment. Fredrik builds these for sale, I think he quoted about $300. You can contact him at Hagenring 35, 3300 Braunschwalg, West Germany.

Speaking of 12-volt batteries, I have noticed a trend among electric fliers and offroad car drivers, including myself, to using a separate 12-volt battery for charging. Why not use the one in your car? One reason is the precarious balancing act I see involving perching the charger on top of the engine, radiator, etc. If it falls down on top of the battery, there could be a short and serious damage to the car. The alternative to this is to run a permanent outlet from the battery to some point in the car where you can conveniently plug it in. I did do this for awhile, but I found that it is hard to put the outlet where it is not in the way, and the extra connections to the battery get in the way if you have to do any work around the battery. There is, of course, the additional risk of running the battery down to where you can't start the car. I have done it, and so have many others!

The two major reasons I have for using a dedicated charger battery are dependability; I buy a new battery and I know it will charge well, and convenience in the shop. It is great to have a handy source of steady

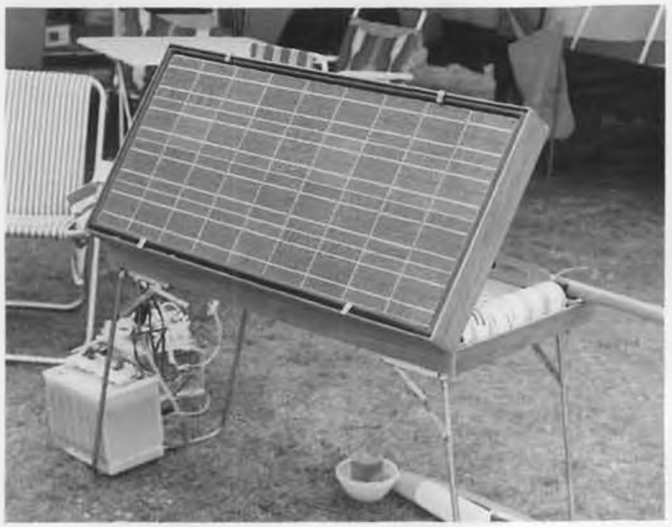
Fridtjof Schussler and his Keller 50/11 powered ME 109 from an Engel (Germany) kit. A .60-size model, it flies exceptionally were on 20 sub-C cells, weighs 7.7 lbs. See text.

This .40-size Ubet biplane flew in very scale-like manner, possibly by Fritz Geist. Most planes this size use 18 cells.

Sport scale Alpha jet from Topp-Modelle, spans 40 inches, five pounds, for 15 to 25 gas, so Astro 15 or 25 with 12 to 14 cells can do it.

Camera tripod with molded-to-match fuselage cradle is the way to go. Open mouth front explained in photo at right.

Removable nose with battery cradle is popular for F3E types. Makes for easy pack change. Throttle included in pod, in front of pack!



Solar charging panel integrated into a field table, will change at .5 to .75 amps in overcast, up to 1.5 amps in sun. See text.

Many good books on electric power and models available in Germany. Each of these, and more, described in text.

12-volt DC where you are working. I use a 6 or 10-amp charger to keep the battery charged, mine has an auto shutdown to trickle mode once the battery is charged. Mine is made by Power-Mate, but there are many such chargers, most in the $50 range, sold in automotive stores. I do not leave the battery in trickle mode, I disconnect the charger and give the battery a new charge every two weeks or so. Do not allow a lead acid battery to stand uncharged, it will never charge up again.

These batteries are heavy, one disadvantage of a dedicated battery. I use a 36-44 Ah (VW Beetle size) battery, which weighs about 30 lbs. I use an ordinary strap wrapped around the battery to carry it, but if any acid leaked, it could destroy the strap. A better alternative would be a plastic or wooden battery box. A garden tractor battery would do very well too. I used one for many years. These usually come with their own carry straps. They are about 20-25 Ah capacity, which is good enough for most one-day flying. They weigh about 20 lbs., which helps too. These are not the deep discharge batteries, which would perhaps be the very best for our type of use, but an ordinary 12-volt battery will last about three years with no problems if it is kept charged. Most will be in the $50 range, as they are the smaller sizes (i.e., VW).

I have used both sealed and unsealed batteries; they both work well. One note of caution: avoid sparks around batteries! The hydrogen gas in the battery could explode! This is very rare, but it happens. If

Continued on page 84

The Grunstadt meet takes place in the heart of the wine country, and is one of the larger meets in Germany. Ho, ho, you, betcha! Robee Models are real Sports!

The Fokker D-VI was a little-known fighter in WW-I, but the family resemblance is easy to spot. Fuselage, engine, cowl, and tail surfaces come from the DR-1 or D-VIII, the cantilever wings are D-VII. Model spans 51 inches, weighs four pounds less radio. Supertigre 40 turns 11-4 prop. Photo by Phil Foster.

FOKKER D-VI

By PHILIP C. FOSTER

First published in *Model Builder* almost 17 years ago, this rare WW-I biplane fighter more than deserves this second exposure. At only 51-inch span (2" = 1' scale), it is easy to transport there's no need to disassemble it. Built light, a two-stroke .40 engine is more than enough power, swinging an 11 x 4 prop.

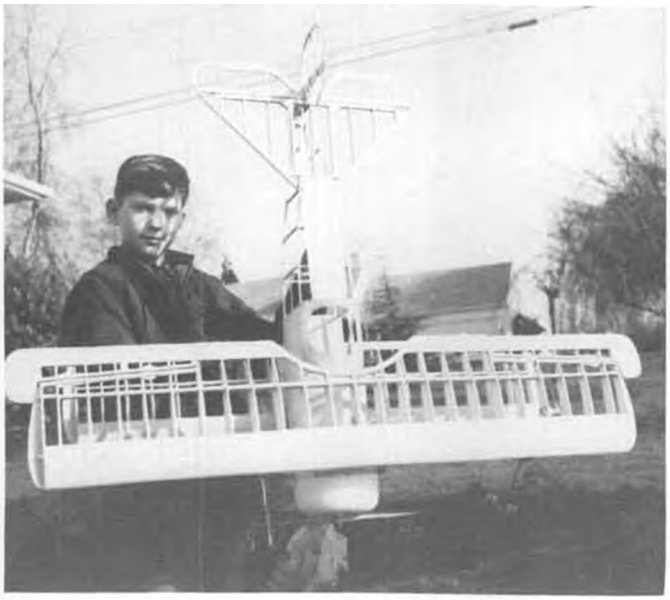
The full-scale prototype Fokker D-VI was designed and built side-by-side with the famous D-VII during the winter of 1917-1918. Competitions for a rotary powered fighter and for an in-line powered fighter were held January 1918, and Fokker won both. The resulting D-VII's story is well known, but its co-winner lost out to its successor, the rotary-engined, parasol monoplane, Fokker D-VIII. The D-VI saw combat in limited numbers in various front line fighter units and with the Austro-Hungarians. References—"German Aircraft of the 1st World War," by Gray & Thetford, and "Development of Fokker Fighters," M.A.N., by Robert C. Hare.

Here is Big Brother! This photo of an original Fokker D-VI was furnished by Pete Bowers, a fellow who is in no need of introduction among collectors of aeronautica . . . or Fly Baby's!

The specifications are as follows: Span 25-1/2 ft., length 20-1/2 ft., height 8 ft. 4 inches, area 191 sq. ft., speed 122 mph, armament two Spandau.

The model is not a spectacular performer by pattern standards. It is slow and insensitive to aileron. Its glide is quite steep with the thick pair of wings. The wide track gear helps keep her straight. Tail high landings are pretty and straight.

I'm a WWI airplane buff of thirty-five

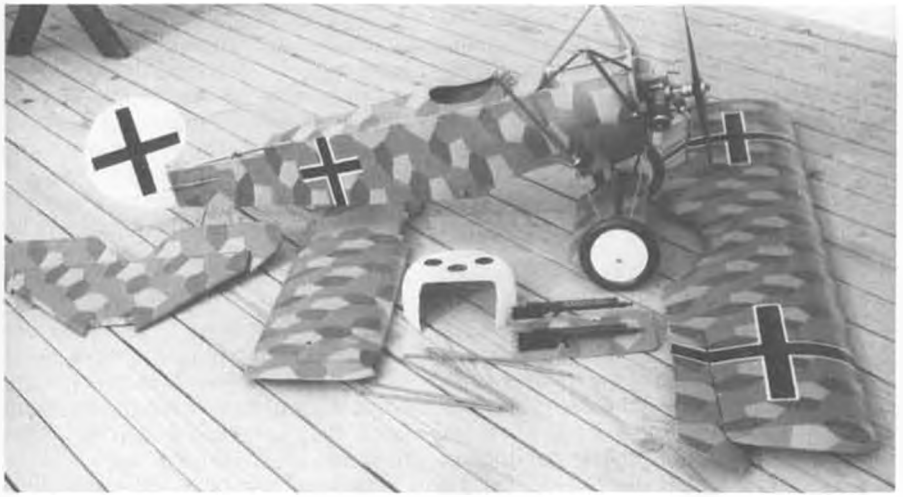


This photo, taken in 1968 is of the author's son, Clark, holding up the bones of the D-VI for display. Construction was kept light.

Author/designer Phil Foster (no relation to the Brooklyn accented comedian) shows the clean underside of the D-VI. Uses a .40 engine.

years' experience and this out-of-the-way model was built because I think it looks good and because most of the well known WWI craft have been built by others. The model is to two-inch scale and is practically "built in." All surfaces come off readily, but mostly I just leave it assembled so I can admire it. The span is only four feet and the total area is 750 sq. in.

Close-up of fuselage reveals engine mount. Guns are mounted on removable hatch which gives access to the radio gear. Everything has to be kept well forward in this short-nosed design.



All ready for final assembly. This is what you might call an "exploded view" of the D-VI. Cabane strut attachment using aileron bellcranks is clever idea.

Color is hexagon day camouflage with pale blue lower surfaces. An alternate standard color is dark green upper surfaces with pale blue under. Cross style is per drawing.

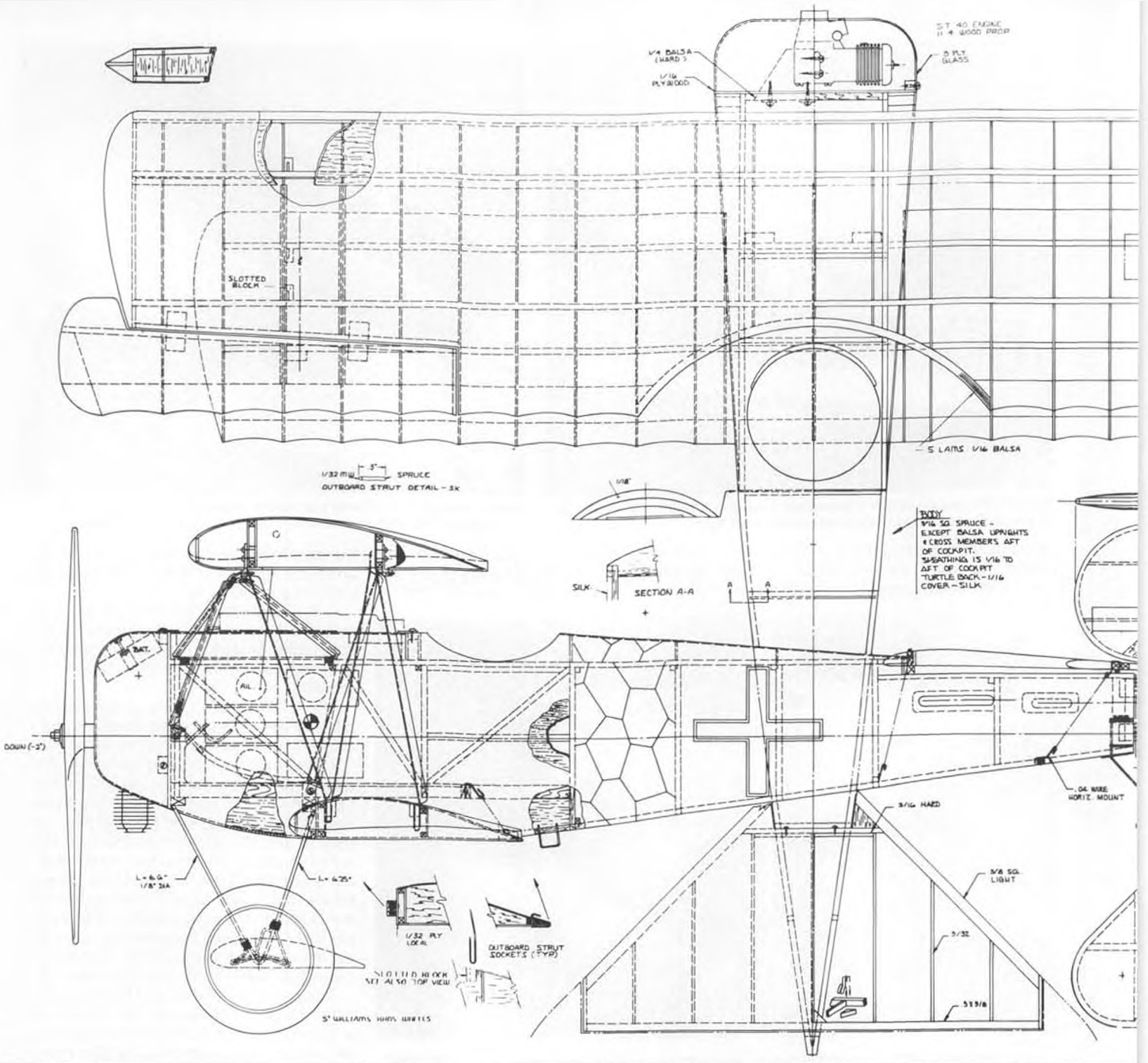
There is no scale rigging, as the original is built as a cantilever wing structure, and I assure you that the model is quite stout.

The wings are tough to build, but the rest is easy. The wings are straight on top but with tapered thickness. The front spar is simple and straight on top, but the rear spar is not straight on top because the airfoil shape gets thinner toward the trailing edge. One other thing before we get into details . . . the airfoil is semi-scale, with the center flat with increasing undercamber to the tip. I don't know what you would get if you tried to make it semi-symmetrical. A flat-bottom airfoil would work OK.

A Super Tiger 40 with an 11-4 prop provides the power. The cowl, even though it is seven inches in diameter, does not appear to interfere with the propeller effectiveness, nor with cooling.

Let's get into the construction, starting with the cowl. Once this is done, you can match the body construction to it . . . rather than the other way around. Carve the cowl shape from a foam block and seal with Sears' ready-to-use spackling paste . . . sand, and then wax. Obtain an eight or nine-inch plastic bowl and mix a slurpy batch of plaster-of-paris therein. Force the carving into the mix and weight it in place until set up. The carving will come out easily. Fill in any holes with spackling paste. Let dry and then surface with paste wax. Wipe the mold with fiberglass liquid mold release and lay in three layers of open weave fiberglass cloth, using polyester laminating resin. Use duckbill metal handshears to trim the cowl to shape.

The body is next. Pin 3/16 sq. spruce longerons in place over the drawing. Pin and glue cut lengths of 3/16 sq. spruce or balsa uprights and bond in place. After this



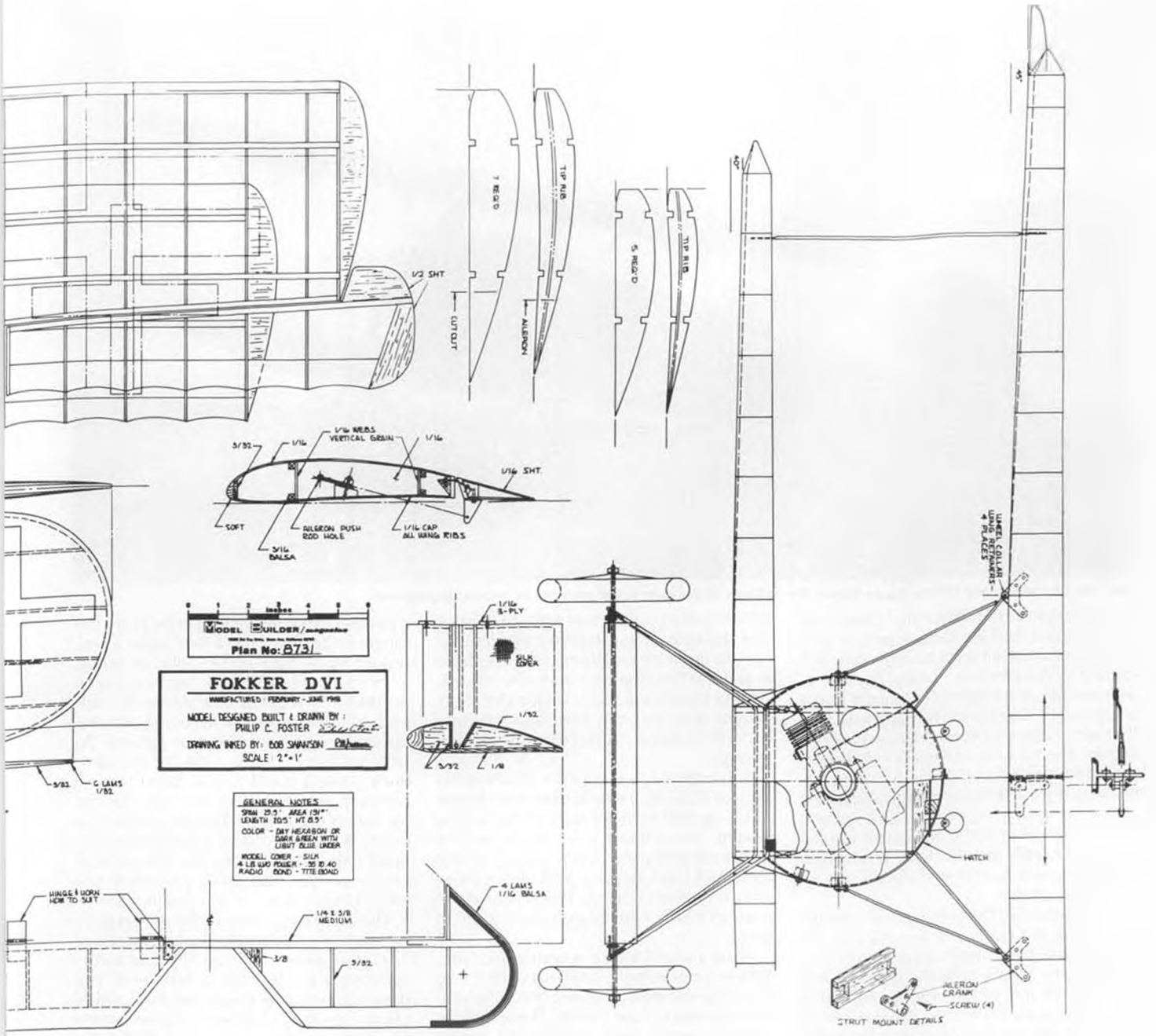
assembly dries, repeat for the opposite side. Now make the forward bulkhead and notch for the longerons. The upper longeron is conveniently straight, so block the body sides, with forward bulkhead, over the drawing. Then pin and glue random cut lengths of 3/16 sq. balsa inside the longerons, making a neat, strong lap joint. This technique makes for fast, enjoyable building. If you use five-minute epoxy, you can make the frame in a couple of hours *(Original article was first published before C/A glue was well known. wcn).* Add the 1/8-inch balsa firewall formers, which should be 1/16 less than the cowl diameter to allow for the forward body sheeting.

The landing gear is next, so it can be bound into position prior to adding more work. It features scale operations, but the stroke of the axle on landing is not contained within the landing gear wing as on the real airplane. It can be contained by tightening up on the shock cords. I left the landing gear wing open on the top for my model. The landing gear wing is removable and is held in place by two inward turned wire pins which are also the anchors for the shock cords. The landing gear is bound onto the spruce across members with heavy thread. Cross brace wires are used on the real airplane.

In order to bring the model along uniformly, we should start the tail group which, when attached, will help the eye keep things true . . . so let's get it framed next. Cut the outline of the rudder from a piece of corrugated cardboard. Cut the outline 3/16-inch undersize to allow for the balsa laminations. Make six strips of 1/32 sheet about 1/4 inch wide. Pin the reduced rudder outline on a flat surface covered with waxed paper or Saran Wrap. After soaking them in ammonia water for 10 minutes, apply thinned Titebond to the balsa strips . . . then stack them. Starting at the bottom of the rudder, pin and wrap the wet laminations around the whole rudder outline. The rest of the rudder frame is quite conventional.

The horizontal stabilizer is scale area and of conventional construction. Select light wood, minimize the glue, and keep the tail light. The stabilizer leading edge radius is to be kept as large as possible, as the wing leading edge radii are large and we don't want the tail to stall before the wings do, even though, like any high sweep leading edge, the horizontal will hang on through large angles without stall. *(OK, aerodynamicists, any comment? wcn)*

The lower wing should be started next, as it is good practice for the upper wing. Make a root and a tip airfoil template. Cut



FULL-SIZE PLANS AVAILABLE—SEE PAGE 106

twenty-four pieces of 1/16 sheet medium balsa of sufficient size for ribs. Stack and pin twelve pieces together and then align. Pin the templates at opposite ends of the stack. Carve and sand the stack and notch carefully. Repeat for the other twelve ribs. Splice 3/16 sq. balsa spars and arrange over the drawing. Block up tips and pin securely. Attach ribs, using Titebond, as this dries slowly enough to make adjustments. Insert the upper forward spar, which is perfectly straight. Let this assembly dry while preparing the upper rear spar, which is also straight (see side view of the drawing). Glue on the upper rear spar. The wing is still very flexible, so make any alignment changes in the jig at this time. Note that when the vertical grain 1/16 balsa shear webs are glued in, the wing will become quite stiff. Cut and glue them in very carefully. Do not leave these out, as they make the upper and lower spar members work as a single deep beam, producing a very rigid wing assembly.

Now add the trailing edge and the leading edge sheeting with the wing off of the board. The false leading edge member makes the leading edge sheeting easy. Next, add the leading edge, and finally, the tips and the cap strips. The interplane strut sockets can now be glued in and sanded flush with the upper surface.

Let's turn to the body again and mount the cowl to the firewall with blocks, as indicated. Now check the firewall to see if it is 1/16 inch below the cowl contour. This relief will allow for the sheeting of the body back to the cockpit. Cut the longitudinal tapered former from 3/16 medium balsa and glue into place. Now glue in the wing cabane strut anchor blocks. Do not sheet yet as we have to attach the wire inboard cabane tripod legs to the upper longerons.

This cabane system is very simple and strong. It is also collapsible. (See illustration.) The pair of inboard legs are of a simple triangular form but should be made very close to the same length as the wing is positioned by them. The long forward leg is made in two pieces, allowing them to be soldered to exact length upon installation. The rear cabane members are also soldered to exact length in the same fashion.

The upper wing is next. It follows the same construction sequence as the lower wing; i.e., cut templates and rib materials, stack, shape, notch and mount on blocked up spliced balsa lower spars. New items in

All fueled up and ready for the Dawn Patrol, the author's D-VI really could pass for its ancient big brother.

this structure are the dihedraled upper rear spar, ailerons, and the cabane fastenings. I recommend that all spars have the dihedral spliced in. Aileron size, control horn location and hinge line are scale, but the horns are standard Goldberg. The cabane fastenings are screw-mounted Midwest aileron cranks. The location of the aileron servo is now determined and this will in turn determine the aileron pushrod arrangement at the wing center section. The section view of the wing at the aileron shows the inclined crank installation. The crank, mounting block, and rod details are an individual choice.

My model had the servo in the fuselage with a link to a crank arm in the wing. The real airplane has a single cable aileron control system coming from the control stick, through the side of the body and entering the upper wing at the rear cabane attachments. If the servo is placed in the wing, the wires could be enclosed in a soda straw, thus keeping the installation neat.

Access to the innards is through the hatch in the body just under the top wing and through the lower wing cut out. The Williams Bros. Spandau machine guns are attached to the hatch and thus are out of the way as you work in this area.

The lower wing is positioned by a key system and internal rubber bands pull the wing forward and up. This internal rubber band trick is also used for the horizontal tail attachment.

With all the cabane fastenings, hatch mounts, and flying surface structures completed, we can finish the body. The cockpit, turtle deck, and the side fairings can be completed. Don't forget to build up the body frames out to the fabric surface with soft balsa. This is advisable for stiffening the body in torsion when covered, and aids in handling the model. In my model I tied the upper longerons together in the cockpit area with sheet balsa. The drawing shows double longerons.

A list of the several things yet to be done is useful at this stage and such a list follows; engine installation, basic weights location, cabane strut assembly installation, control rods, interplane struts, covering and finishing.

The engine is oriented for serviceability and for cooling. It would have been better to be upright in order to raise the engine weight. Any mount you choose will be fine. I made my own from a piece of 5/8-inch thick birch shelving, with down thrust of two degrees built in. Wood screws are used to attach both engine and mount in place.

Now a word about weights location. When a model rolls, it will do so about an axis determined by the weights of the various elements of the model. These include wing(s), servos, fuel, battery, tail group, wheels, and engine. For inherently stable flight, the axis of this distribution should be higher at the nose than at the after part of the model. The effect is to slightly yaw the model to the side of the low wing which increases the lift on the forward wing while the yawed vertical responds to return the model to the direction of flight. Pattern models don't want this stability . . . scale models mostly do. *(Interesting theory . . . any comments, readers?)* The D-VI gets this distribution by keeping the tail group, which is above the roll axis, very light and by placing the internal weights high in front to counter the landing gear weight, which tends to lower the roll axis in front.

Skilled fliers may get by without considering stability as very important. The drawings show where I placed my weights.

Alignment of the cabane system and upper wing is a logical next step. Insert the inboard cabane into the wing fittings and prop up the wing, i.e., 'til the lower surface is parallel to the upper longeron. From the longeron to the wing lower surface you should have three inches (plus or minus 1/16 inch). Now solder the two-piece outboard forward cabane strut with both ends in their respective fastenings. Do the same operation for the rear cabane. To remove wing, simply slide off the bent ends. I use a small rubber band looped between the front and rear wing fittings for retention. I had originally planned to use 1/16 Du-Bro collars at the forward fittings only, but failed to provide enough clearance. You can make a recess in the wing if you want a neater installation.

The interplane struts of the model carry no load. They are made using one piece of 1/32 steel wire bent in an "N" and incorporating a spring loop at each end. The drawing shows the shape, but for drawing clarity the dihedral allowance is not shown. Measure and bend the wire. Make the wood fairing with 1/16 spruce, contour bind each end to the wire, bond, and cover with Silkspan. The balsa sockets in the wings must be flush to the covering to minimize tearing. The loop ends of the struts help in this regard.

The WWI scale model fan has benefited greatly since the advent of the Williams Bros. scale guns. All that is needed is directions as to how many, and where and how mounted. For the rear gun mount, a transverse 1/16 wire rod is attached to the underside of the hatch balsa skin with balsa blocks. The wire is bonded in place and when the bond sets, twist the wire and break it loose. The wire can now be pushed from side to side. The guns now drop into a cutout in the hatch and the wire rods slip through the mounting holes provided in the guns. The forward mount must be made of thin aluminum . . . bent into a "U"

Continued on page 74

TAKES AN HOUR TO ASSEMBLE, FLIES LIKE IT'S MADE OF BALSA AND WON'T GO TO PIECES WHEN YOU CRASH IT.

55" wing span, 21" length. High start included. Two-channel rudder and elevator control.

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CHOPPER CHATTER

By JAMES WANG

John Gorham, of Gorham Model Products, hovers his colorful Rebel, which is very relaxing and easy to fly. All metal parts come anodized in black.

In this month's *Model Builder*, we will finish our product review of the Schluter Magic and Futaba 9VHP. In the Chopper Column we will talk about a brand new helicopter that is specifically designed for the beginners, the GMP Rebel. In fact, this month's column is ideal reading for R/C airplane guys who are curious about starting in R/C helicopters. The Rebel and Magic represent two extremes in the design spectrum for R/C helicopter. Magic is the sophisticated, fully aerobatic contest machine that can do magic in capable hands (retails for $795). The Rebel is a simple-to-build, very stable helicopter with limited aerobatic capability (retails for $240). For readers who are familiar with R/C aircraft, the Magic is like a full-house 60 size Tiporare pattern plane . . . smooth and slick. The Rebel is like the Falcon 56 trainer . . . docile and stable. The rest of this column will discuss the Rebel design philosophy, flying impressions, and design features. Next month we will closely examine the 50-size Kalt Cyclone II, and have the concluding story on the F3C Helicopter World Championships; including the technical specifications table.

Show stopper of the month. This modeler in Japan owns 42 R/C helicopters. How many can you name? Is this a record, or is there a reader out there with more helis?

According to CMP, the concept for the Rebel was born around December, 1988, and in April, 1989, GMP revealed the prototype at the Toledo Show. After extensive flight tests and further improvements, the final product was ready in September, 1989. By December, 1989, over 500 Rebels had been sold. The design philosophy was to market a very inexpensive helicopter that is super-simple to build, set up, and fly, and to attract more people to the wonderful hobby of R/C helicopter. At a retail price of $240, it is the lowest priced R/C helicopter kit on the market. All parts of the Rebel are manufactured in the U.S.

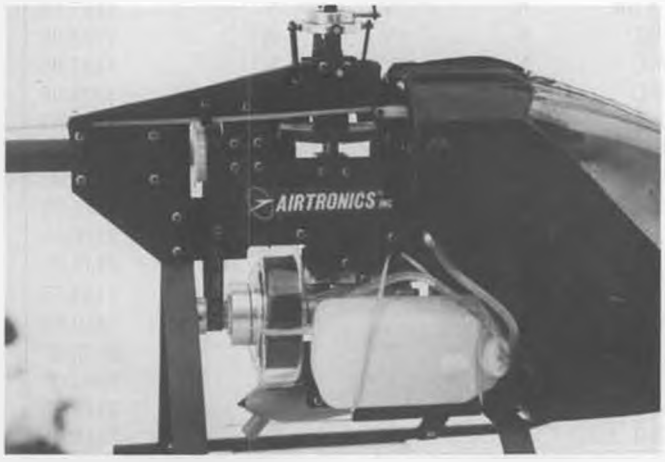
To keep it simple to build and set up, fixed-pitch design was chosen. This eliminates the complexity of the collective pitch change mechanism, which means less things to break down, simpler to maintain, and most important of all, it means that a special helicopter radio is not required. As it is a fixed-pitch design, only four servos are needed, and any R/C airplane radio would work perfectly. The Rebel is designed for regular R/C airplane engines, too. With an abundant selection of inexpensively priced 40-45 size airplane engines available, GMP believes that many beginners can now afford to give the R/C helicopter challenge a try. The Rebel will also permit the veteran airplane flier to use existing airplane radios and engines. This reduces the initial cost to only the helicopter kit . . . a significantly lower outlay.

By the way, that's partially what tempted me to R/C helicopters. Back in 1976, I bought a fixed-pitch Schluter Heli-Baby for only $200. I used my Kraft 4-channel airplane radio and engine. But now, 14 years later, this helicopter itch has stuck to me forever. It grew on me to the point that my full-time job is doing research on full-size helicopter dynamics and aerodynamics. The whirling blades beating the air to submission present the engineers with many challenging problems. As for modeling, I have built about 30 different designs during the past 14 years; including some scratch built. But look at the picture of a modeler in Japan with his collection of 42 choppers. He is more nuts than me!

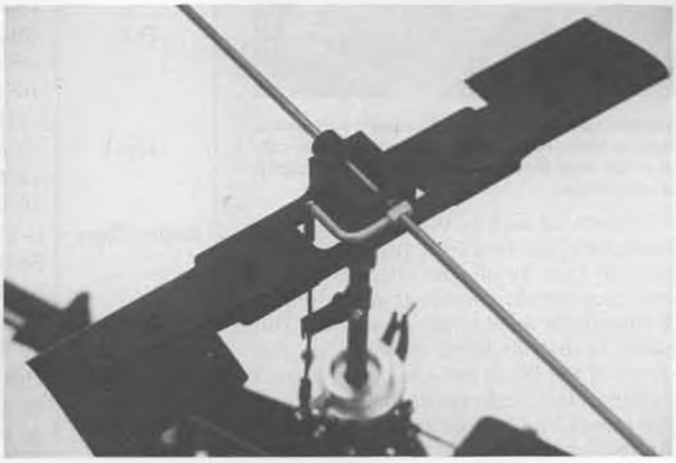
Coming back to the Rebel, I hope the Rebel will help many beginners learn to fly R/C choppers in the same way the Heli-

The Rebel parts are organized into 12 bags. Instructions are clearly written, well illustrated, and geared toward total beginners.

Rebel designed for regular 40-45 airplane or heli engines, standard mufflers. Cone start feature for airplane electric starters.



An 8-ounce Du-Bro fuel tank, metal swashplate, wide stance landing gear, easy, slide-on canopy. Everything simple.



The one-piece molded hingeless rotor head. Has soft individual blade flapping and Hiller control. Works great.

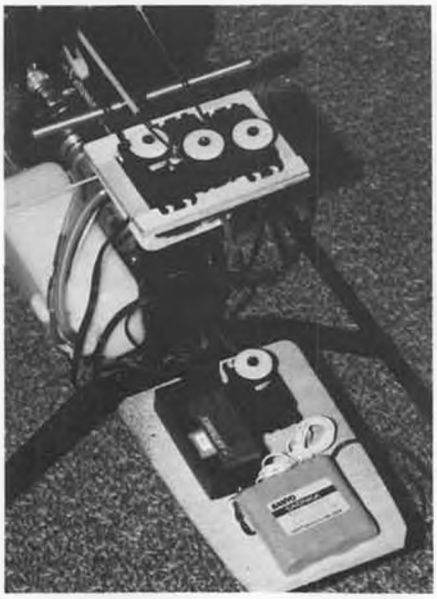
Baby taught me and others. As I learned on the fixed-pitch Heli-Baby, flying the Rebel was a piece of cake. In fact, the fore/aft and left/right stability makes it one of the most stable of all the helicopters. This is due to the soft flapping hingeless main rotor head design. When Mr. Gorham told me about the idea of a simple fixed-pitch helicopter a year ago, I said why not use a hingeless design completely molded from nylon? Real helicopters like the MBB BO-105, Westland Lynx, and Aerospatiale Panther all use a hingeless rotor design. Model helicopters like the Kalt Baron 30 and Cyclone I also had the hingeless design. I still think the old Baron 30 and Cyclone I were two of the most docile beginner helicopters. The beauty of the hingeless rotor is that it has no rigid teetering motion. Blade flapping is accomplished by elastically bending the semi-flexible rotor hub flexbeam. GMP went ahead and developed, engineered, and tested the nylon hingeless head.

Instead of our normal review procedure, this time we will begin by discussing our flying impressions. First of all, you should install a reliable 40 to 45 size engine. A 50 would be overpowering it. A friend who has flown a 50 powered Rebel described it as "quick," like a fast collective helicopter. That just defeats the intention of the Rebel. The engine should have smooth throttle response. If you have a broken-in, and dependable engine from your R/C airplane, then that would be ideal. I have compiled a list of over thirty 40-46 engines that will fit Rebel. Most of these engines can be picked up at hobby shops for less than $100. Probably the safest bet in selecting an engine is to show this engine list to some of your local airplane fliers and ask if they have good experience with any of the engines. Then buy that engine. We recommend a 45, or a very healthy Schneurle 40.

Because Rebel has a cooling fan system, it is not essential to use a helicopter engine with heat sink head. One benefit of using an airplane engine is that most airplane engines come with a muffler.

Fixed-pitch helicopters like the Rebel ascend or descend by changing the engine rpm to change the main rotor rpm. Normal main rotor hovering rpm is around 1500. Contrary to intuition, when the throttle

Soft flapping hingeless head makes Rebel very stable. Compact size (42-inch rotor diameter) makes it convenient to transport, yet big canopy makes it easy to see at a distance.



Simple radio installation. Standard Airtronics airplane radio used, using four servos; pitch, roll, tail rotor, and throttle. Optional gyro is highly recommended.

stick is moved slightly, the rpm only varies one to two hundred rpm, not many hundreds of rpm. Small rpm change is sufficient to generate a noticeable amount of lift change for vertical motion control. The reason is that lift force depends on the square of the blade velocity; thus, a small change in the blade rotational speed can generate quite a change in the rotor thrust. The reason that fixed-pitch helicopters have slower vertical response is due to the fact that a rotating rotor system has rotational inertia, and it takes time to speed it up or slow it down. This is what gives the slightly delayed vertical response. After a few flights you will automatically develop a feel to anticipate and feed in the proper engine commands for smooth flying. The analogy is . . . once you learned how to ride a bicycle, you automatically anticipated and picked up cues that your bicycle was leaning, and you corrected the balance automatically.

Aside from the vertical response difference, the cyclic control and tail rotor response are just the same as on any collective pitch helicopter. In hover, where you usually do not make large vertical motion changes, the Rebel is excellent. In forward flight, where we normally cruise at a constant throttle setting, the Rebel handles like other collective pitch helicopters. The major handling difference is during the landing approach. The new breed of collective pitch R/C helicopter fliers may not be familiar with Rebel's approach method. It's all right for a collective pitch helicopter to come in "hot." The pilot can hit power/collective at the last moment to flair the model. Fixed-pitch helicopters like the Rebel need to be landed more like an R/C airplane. As the rotor blade pitch is fixed, you need to reduce the throttle to about ¼ and "glide" the model in. Avoid a sharp descent angle. And never, never, pull the throttle stick back completely because the rotor rpm will drop too much.

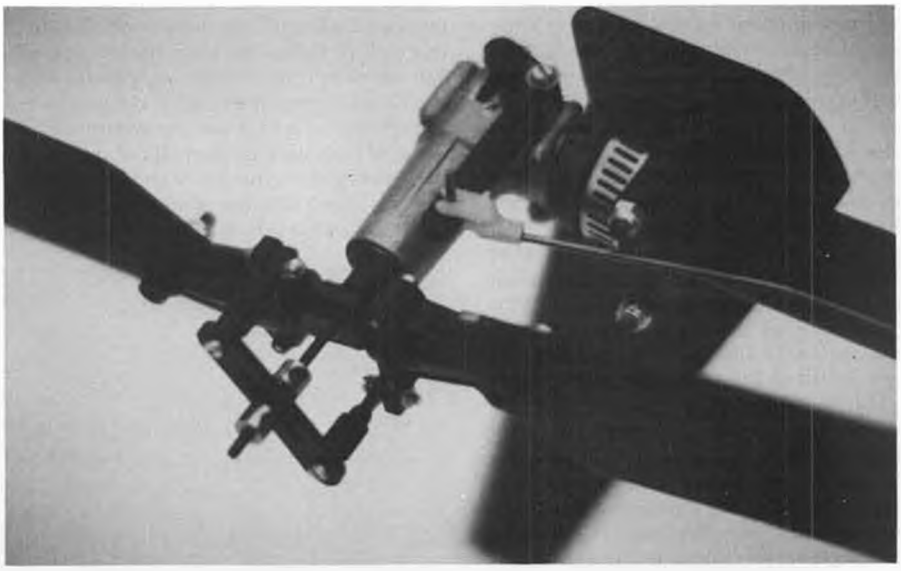
You need to set up a landing approach and start flairing earlier. Instead of flairing the model with the elevator, like an airplane, you flair it by increasing the throttle gradually at about 30 feet. At 30 feet the throttle should be at least one half. At 10 feet altitude, increase the throttle to full and start to pull back on the elevator, like landing an airplane. The model starts to flair and the sink rate will slow down to zero at about 5 feet high. Now the descent has halted, and you are back in the hover position. Reduce the throttle to your normal 1/2 to 3/4 hovering position. The key trick is to come in on a nice slow approach like the airplane, even slightly slower, and to feed in power early to flair your helicopter.

Once you know how to hover, do for-

Continued on page 96

Engines for use in Rebel

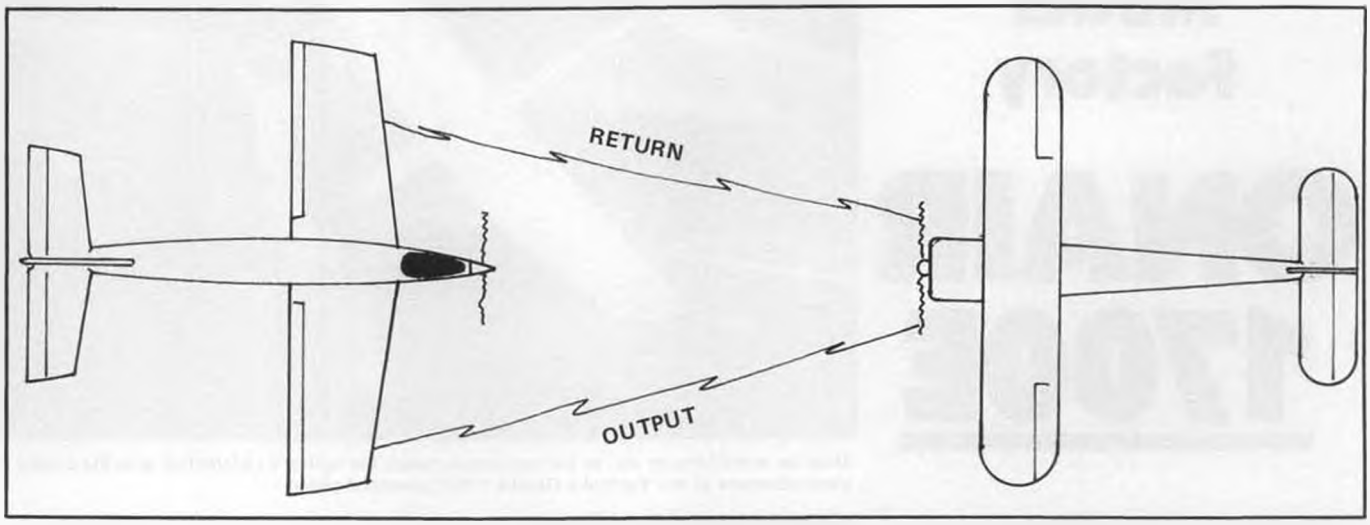
Name	Model	Heat Sink Head	Muffler Included	Crankshaft Ball Bearing	Retail Price
Aristo Craft	45 FSR RC	N	Y	Y	$125.00
Como	40RC	N	Y	Y	$134.99
Enya	SS40	N	Y	N	$95.98
	SS40BB	N	Y	Y	$129.98
	SS45BB	N	Y	Y	$145.98
Fox	40RC BB	N	Y	Y	$94.95
	40BB Deluxe	N	Y	Y	$109.95
	45BB Schneurle	N	Y	Y	$119.95
Irvine	40RC	N	Y	Y	$99.95
	40RC ABC	N	Y	Y	$114.95
K&B	40RC	N	Y	Y	$110.00
	40RC Sportster	N	Y	N	$ 90.00
Magnum	GP40 FSR	N	Y	N	$79.95
	Pro40 FSR	N	Y	Y	$122.95
	Pro45 FSR	N	Y	Y	$127.75
O.S.	40FP RC	N	Y	N	$104.95
	40SF RC	N	Y	Y	$194.95
	46SF RC	N	Y	Y	$209.95
	46SF-H RC	Y	N	Y	$199.95
Royal	40 ABC	N	Y	Y	$94.95
	45 ABC	N	Y	Y	$104.95
	46 H	Y	Y	Y	$125.95
Supre Tigre	G40	N	Y	Y	$119.95
	S40K	N	Y	Y	$149.95
	S45K	N	Y	Y	$154.95
Webra	40 Silverline	N	Y	Y	$119.99
	40 Speed Ring	N	N	Y	$122.99
World ASP	40RC	N	Y	Y	$95.00
	46 FSR	N	Y	Y	$114.95
	46 FSRH ABC	Y	Y	Y	$119.95



Tail rotor gear box is factory assembled. It is a wire drive system. The vertical fin is pre-cut from Bob Violett's Magnalite material.

The 90s R/C Model Mid-Air Collision Avoidance System

By ELOY MAREZ



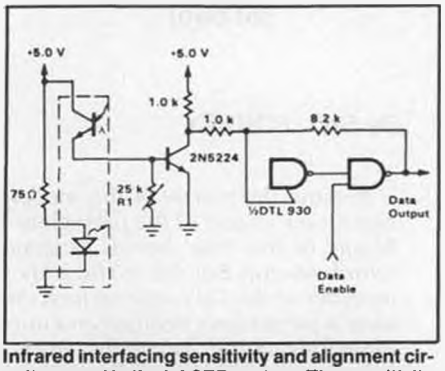
Operation of the LASER Mid-Air Collision Avoidance System depends on a signal reflected by another model in the same flight path. When such a target is sensed, the LASER equipped model takes immediate action to avoid a collision. Such action is programmable by the user, though a sharp left and down is recommended, and can be adjusted to match the maneuverability of the airplane.

If ancient history is to be believed, one of the earliest successful attempts by man to fly was made by a Greek named Daedalus. History has often proved to be extremely fickle, and in this case does so in two ways: (1) it is seldom mentioned that Daedalus also introduced formation flying, and (2), his wingman, Icarus, became the most famous of the two. Icarus, of course is remembered for having coined the phrase "MAYDAY," when after flying too close to the sun, the wax holding his wings on melted and he suddenly lost all airspeed and ultimately all altitude.

The whole story is that Daedalus and Icarus, actually his son, found themselves as guests of the Greek government on the prison island of Crete. Club Med not yet being in operation and being a kind and conscientious father, Daedalus pondered for many months as to how to get Icarus off the island before he became overly fond of sheep. His inspiration came one day when sitting on the cliffs . . . birds! Flying! His research finally led to both of them being airborne over the Mediterranean enroute for Athene. Now the ancient, and probably the modern Greeks, might buy that story about the wax and the sun, but as we now know the fallacy of such thinking, the real reason for Icarus's untimely ditching at sea could well have been a MID-AIR collision with Daedalus, who was fortunate enough to survive.

Yes, the mid-air collision, for whatever reason, has been with us from the early days of aviation. And for decades, it was accepted as one of the risks, the only prevention thought to be better visual surveillance outside the cockpit. In the escapement days of R/C, when one person flew and everyone else watched, mid-airs between models were not a problem. However, as the equipment and our personal skills evolved, so did the danger of in-flight collision, and though the fact is not a part of recorded history, I'm sure the first cry of "Ah Stuff" came along rather soon after more than one R/C model hit the blue in the same flying area.

Like full size aviation, we too have accepted the mid-air collision as one of the inherent dangers. However, as the R/C population increased, and the skies over our flying fields got increasingly crowded, mid-airs came to be a serious problem, and a solution had to be sought. The solution, when it came, was relatively simple, but initially, when weight, size and cost were primary considerations, the project often appeared hopeless.

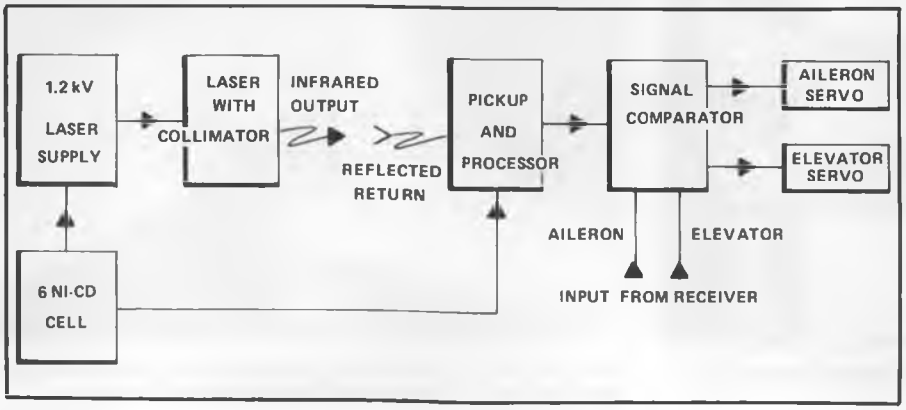


Infrared interfacing sensitivity and alignment circuit as used in the LASER system. The sensitivity is adjusted with pot labeled R1, a voltmeter clipped across the 8.2K resistor provides a peak for perfect alignment with the reflected signal. Mixing with the receiver signal inputs to the last 930 section.

To start, a study was made of existing technology, since it is known that both the military and commercial airlines have a great interest in mid-air collision avoidance. Also, there are many motion and object detection devices already in existence, alarm systems, and vehicular collision warning systems from which technology could be borrowed. I won't bother to detail the amount of research and self-education that was done, as none of it led to anything even remotely useful, mainly for size and weight, or cost reasons.

Two breakthroughs came almost simultaneously. One was the appearance of a new book entitled "The Laser Cookbook," in the tradition amongst electronic publishers who like to tag how-to publications with names like "The Op-Amp Cook-

Continued on page 106



Yoshioka Model Factory

ONAIR 1700E

Must be something he ate, as the expression belies the author's satisfaction with the quality and innovativeness of the Yoshioka ONAIR 1700E powered glider.

PART ONE
(of two)

By BILL FORREY

Because the review of this model was carried out as part of the prestigious R/C Model of the Year Awards program, in which Model Builder *is the only U.S. member of the 12-magazine jury, the review is particularly detailed and unceremoniously critical. Just as this article was being prepared for publication, it was learned that the Yoshioka ONAIR 1700E has won the competition in the Glider category, which will have been announced at this year's International Toy and Hobby Fair in Nuremburg, Germany, by the time you read this. Further details on the judging criteria is explained in Bill Forrey's article.*

YOSHIOKA MODEL FACTORY
ONAIR 1700E

Having recently been appointed as a Jury Member to the R/C Model of the Year Awards, it is now a privilege for me to review and judge models which are being sent my way from various manufacturers. This submission process starts with the manufacturer contacting the international RCMYA coordinator, Guy Revel, of Courbevoie, France, who then determines who judges what and helps the manufacturers reach the many reviewers with products. The Model of the Year Awards are presented every year in January at the International Toy and Model Show in Nuremburg, Germany.

To give you an idea of the magnitude of this effort, there are 12 jurors assigned to R/C gliders alone from 12 magazines in seven countries (five European, plus USA and Japan).

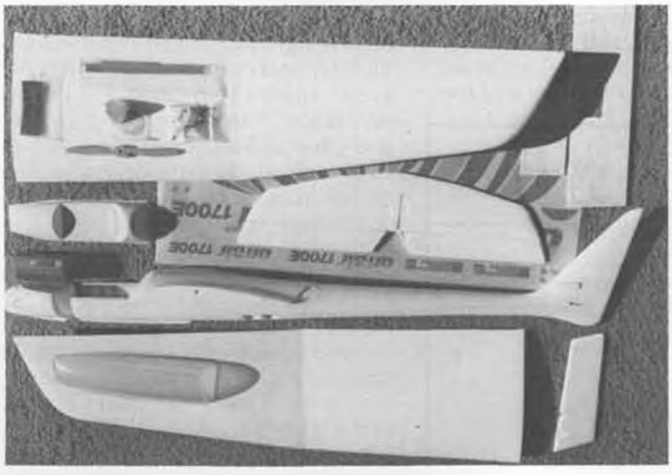
I thought that I'd share with you how I judged the first model submitted to me, the Yoshioka Model Factory ONAIR 1700E, available in the USA through Hobby Dynamics Dist., 4105 Fieldstone Dr., Champaign, IL 61821.

What follows in this "Products in Use" review is an edited and more detailed version of my findings as I reported them to Guy Revel early this past January. RCMYA Judging Rules say that jurors must award points to the models on a scale of one to five (five being perfect) in four basic areas of design. These areas are: (1) quality of the design; (2) quality of the kit; (3) suitability of the model for its intended purpose; and (4) innovation.

I have judged the many details within these four areas on this same 1-5 scale, starting each detail as a perfect five and subtracting from it for every negative finding. I have averaged these details to achieve each area's score. The point total is a simple sum of these four areas. On to the review.

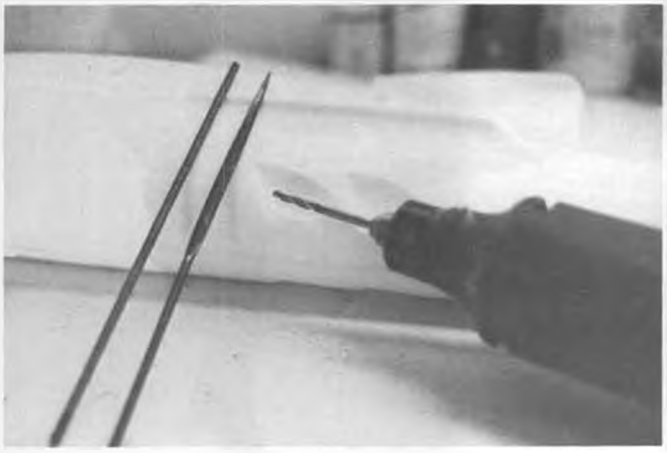
AREA I: Quality of the design, 4.0 average.

First detail: aesthetics. The ONAIR 1700E's design is sleek, visually well balanced, attractive, and modern. From a distance, the ONAIR has all the looks of a very well designed, well executed, high per-

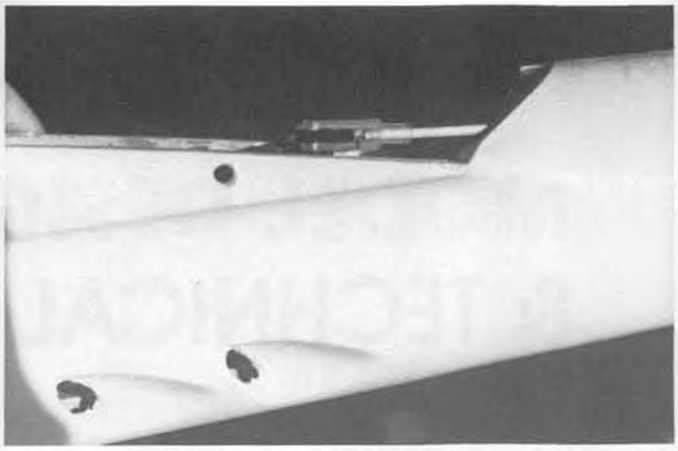


The parts spill-out tells the story on the quality and quantity of prefabrication of the Yoshioka Model Factory ARF kit.

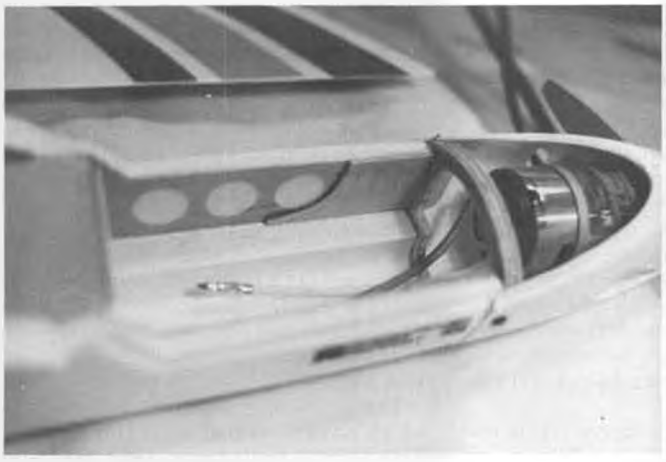
Cutting slots in fin and stab must be done with extreme care for proper alignment. Note pre-installed, double nylon sheath pushrods.



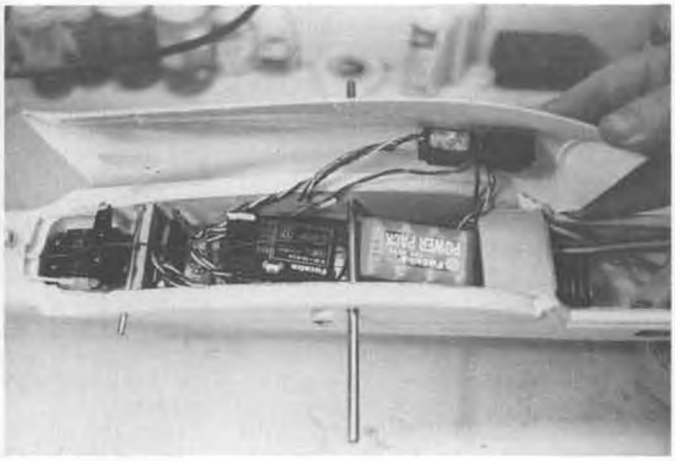
Cutting open the air exit holes is best done with Dremel tool and needle files.



Micro servos are a must! Use inner control arm holes or excess height will interfere with hatch fairing.



Motor attaches to light ply mount with four small screws. Motor housing is separate blow-molding.



It's a tight fit all the way! Note cut-outs in hatch to clear servo arms. Moving battery forward makes ship nose-heavy.

formance polyhedral motorglider. However, there are a few minor but nevertheless detracting details.

The first detracting detail is a subjective and minor personal criticism about color. The ONAIR lacks a little excitement colorwise. The ONAIR is all white with only small areas of three-color decal trim on its wing tips and stab tips. The trim is very nice, but there is not enough of it to be really exciting.

Also, there is not enough dark color trim on the bottom to give contrast with the sky when the ONAIR is backlit. In fact, its translucent white wings look light gray from below with the sun shining from above, and this color frequently blends in with overcast sky or hazy air. The ONAIR is sometimes hard to see.

For the creative modeler, the relative lack of color can be viewed positively. Paint can be added (test first for compatibility). Trim sheet colors may be added. A colorful, personal touch would be very easy to achieve.

Detracting from the physical beauty of the ONAIR from a close inspection is its separate blow-molded plastic fuselage nose section. Evidently, the innovative and new skinned white foam fuselage material

Continued on page 107

First launch. Climb is fast and flat, but very good . . . about 300-400 ft. per minute depending on battery and prop.

MODEL DESIGN & TECHNICAL STUFF

By FRANCIS REYNOLDS

THE BRUISER HELICOPTER STORY

I chatted with an unusual modeler today. I think you will be interested in his story. It is definitely technical model stuff.

John Smith (honest!) is a partner in Pacific RPV Company, located in the foothills of the Cascade mountains northeast of Seattle. The company is an outgrowth of Pacific Helicopters, where John was previously involved in full-scale helicopter applications. He has been a modeler since 1948, however, including control-line and R/C planes of all kinds. By 1973 he was into R/C helicopters.

John bought the biggest model helicopters he could find and started using them on the job for some of the work previously done by full-scale choppers. One application I found particularly fascinating . . . he was hired to land an R/C helicopter on the backs of whales in the Atlantic Ocean!

WHALE HELIPORTS

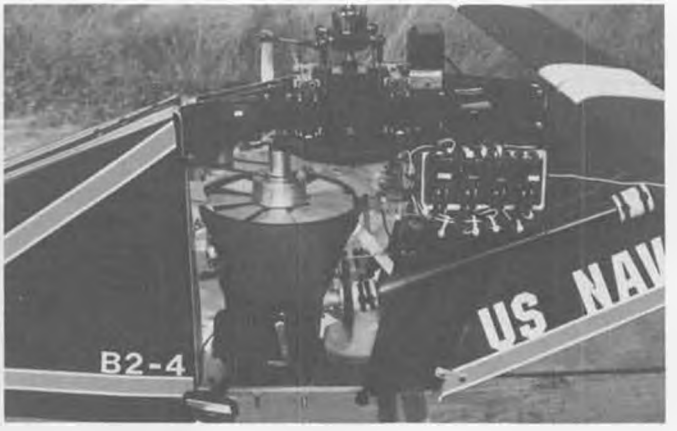
Four years ago, Oregon State University had a program to track 50-ton humpback whales off Cape Cod by attaching radio transmitters to their backs. The transmitters were equipped with telemetry to record the times when the whale dove, how deep, and how long it would stay under. The subsequent transmissions were received by a satellite and relayed back to earth. From the satellite data, the latitude and longitude of the whale could also be determined. The transmitters were housed in five-inch diameter flying-saucer-like cases with retracted hooks on their rims. These devices were originally fired at the whales with special guns, which endangered the animals.

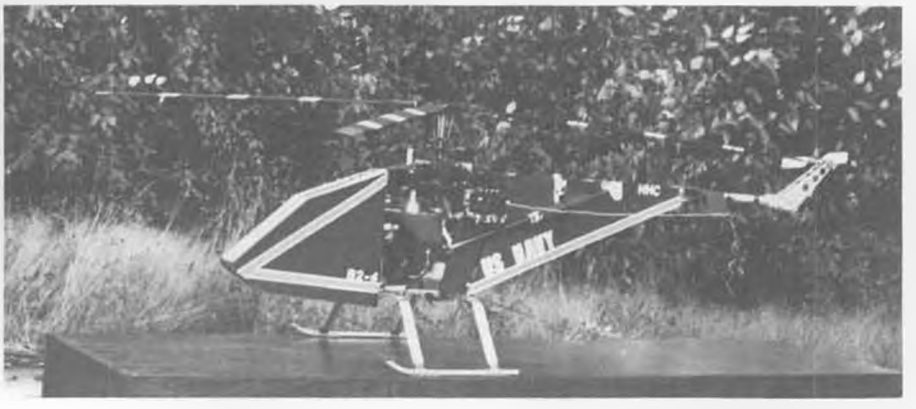
Enter the model helicopter. With the "tag," as the whale tagging device was logically called, carried on the bottom of the model, John would actually land the chopper on the whale. The hooks would be automatically triggered and set as soon as the tag made contact with the animal's back. A transmitting antenna would also erect. John would then fly the model helicopter back to the fishing boat from which he was piloting. In order to reduce the problem of depth perception, he would fly from as high on the boat as he could; tied to the radar dome.

You will sleep better to know that shortly after the tests were completed, the whale's natural defenses rejected the foreign object on its back.

THE BRUISER

The whale tags weighed five pounds, which was an acceptable load for the GMP King Cobras (with Super Tigre .90s) they were using. For certain other work, how-





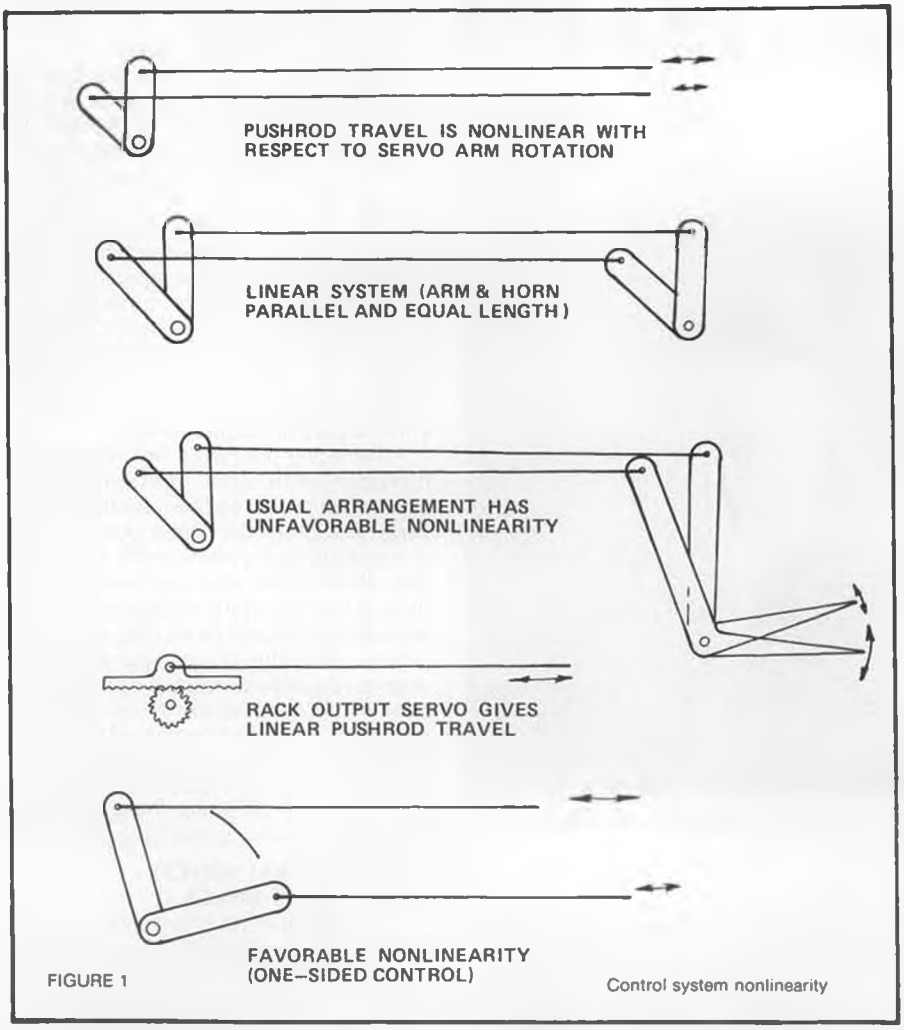


FIGURE 1 Control system nonlinearity

ever, this largest-available chopper model just wasn't big enough. So the "Bruiser" was born. Ray Hostetler mentioned this model and John Smith's work briefly in his "Hover" column, in the February '89 issue of *RCM*, page 22.

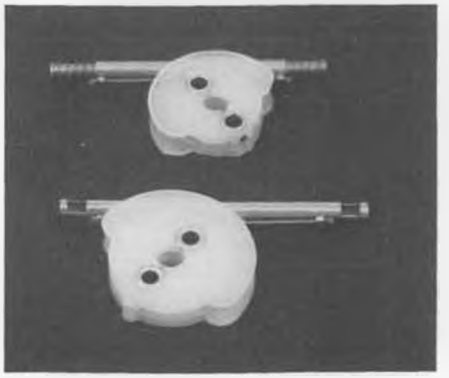
The Bruiser is a bruiser. It will carry a payload of 20 pounds at a maximum gross weight of 40 pounds! It has been powered with Saito 270 and Saito 300 twin fourstroke engines, and is now equipped with the Tartan Super Twin gasoline engine. The Bruiser was designed jointly by John Smith and Eric Dustrude.

Eric has another little company, "Aerial Visions," which you might guess is in the aerial photography game. He employs his Bruiser in commercial photographic work, using a 35mm camera and a video camera. The view seen by the video camera is transmitted down to the camera operator, who is separate from the helicopter pilot. The cameraman can therefore see what the 35mm camera in the vehicle sees, and adjust the camera accordingly. The camera and its attached video sighting system are radio controlled in azimuth and elevation separately from the helicopter.

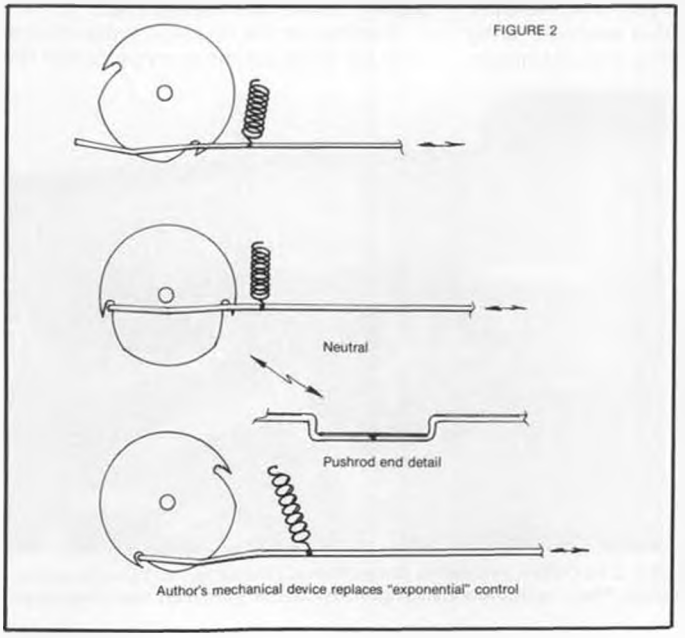
Meanwhile, back at Pacific RPV, John Smith and his partners are building and selling Bruisers to other commercial customers. They are currently working on one for the United States Navy. If you happen to need one, they will take your order. The basic model with gyros, telemetry, and an alternator sells for around $10,000 ready to fly. If you want more neat things and keen stuff you can get a Bruiser with autopilot, on-board electric starter, and other goodies for up to $25,000. The address of Pacific RPV is: P.O. Box J, Startup, Washington 98293, phone (206) 793-0123.

I almost forgot. Another of John Smith's adventures involved a ventriloquist. Years ago he designed and built a very sophisticated R/C ventriloquist's dummy. In the act, the ventriloquist would get into a

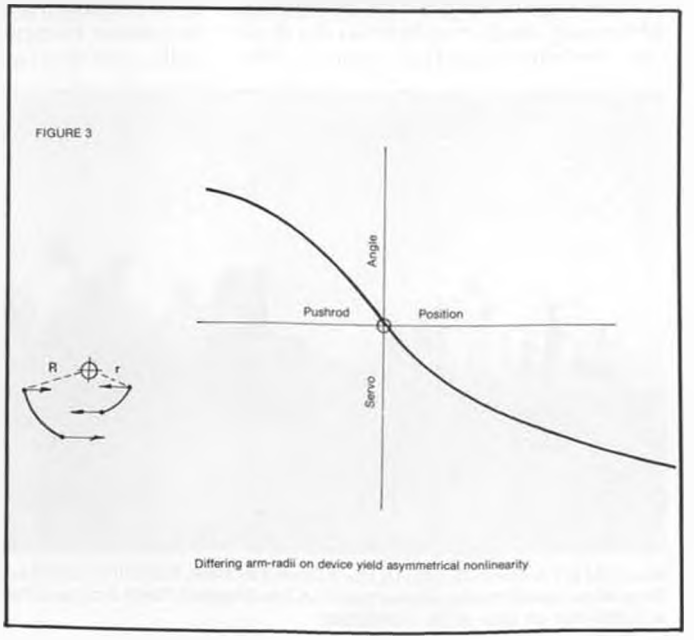
Continued on page 99



"Line Drive" by Model Products, Corp., converts conventional, non-linear rotary output servo motion to linear. Hmmm, now if you offset the mounting hole it would be possible to get reversed non-linear motion; low near center, high at the extremes!



Author's mechanical device replaces "exponential" control



Differing arm-radii on device yield asymmetrical nonlinearity

R/C SOARING

By BILL FORREY

Matthew Collier placed second in a recently held "Maui-Style" F3J meet on the slopes of Mt. Haleakala, flying his Carl Goldberg Gentle Lady.

"SCHUEMANN WING" TIP STALL EXPLANATION

In the December, 1989 *Model Builder* R/C Soaring column there appeared a letter from Wil Schuemann explaining (from the source) just what exactly a "Schuemann wing planform" was. This letter was in response to a couple of questions that I had for Mr. Schuemann several months ago, one of which was apparently not answered to his own satisfaction. That question was: Why are we hearing so many reports of tip stall behavior with the "Schuemann wing shape," specifically, multiple taper tip panels with (relatively) straight trailing edges? What follows is a possible explanation from Mr. Schuemann which may shed some light on the situation. The letter is dated December 11, 1989.

"Dear Bill, I was reflecting on your question regarding 'tip stall problems' when modelers use variations of this wing shape we are calling the 'Schuemann planform.' The following is a plausible explanation for this observed phenomenon.

"In its simplest form, a 'Schuemann planform' has no dihedral, but does have a straight trailing edge which is perpendicular to the fuselage center line. This, at least to a first approximation, eliminates lateral pressure gradients near the trailing edge of the wing, and therefore prevents small separations in one area of the trailing edge from propagating laterally. It is therefore reasonable to expect that when the wing stalls, it will do so over the entire semispan simultaneously, which could produce an abrupt stall on one side which could be interpreted as a tip stall.

TRAILING EDGE SWEEP. WHY?

"Figure 1 shows a 'Schuemann planform' similar to the one you showed in your column in the December, 1989 *Model Builder*. Because of a small amount of forward sweep in the trailing edge behind the flap, air separation at the trailing edge behind the flap is 'drained away' by moving it toward the root of the wing where it will become a part of the root separation. Similarly, because of a small amount of aft sweep in the trailing edge behind the aileron, air in a separation at the trailing edge behind the aileron is 'drained away' by moving it toward the tip, where it will become a part of the tip vortex.

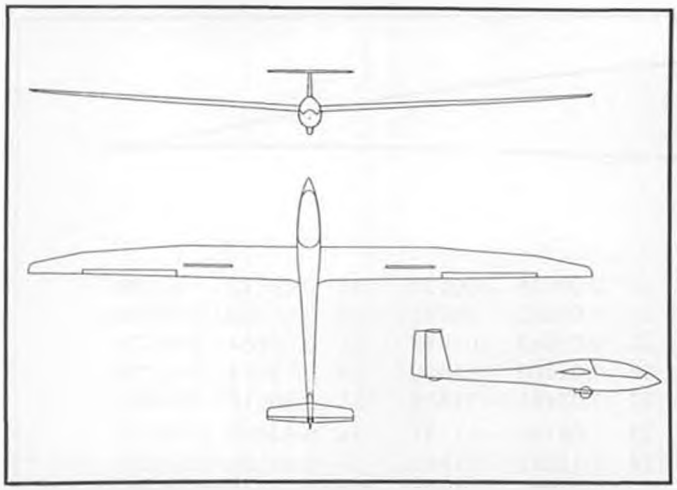
"The center portion of the semispan will therefore be protected from stalling at the expense of the tip and root portions of the wing. This allows the center portion of the semispan to operate efficiently right up to the stall, while the separated areas near the tip and root gradually enlarge as the wing approaches the stall producing a relatively benign stall. This design approach gives improved stall behaviour while preventing root or tip separations from 'feeding' separated air toward the central portion of the semispan as the wing approaches the stall, which would produce increased drag and decreased lift when flying slowly, as occurs with conventional wing planforms.

HOW DIHEDRAL AFFECTS 'SCHUEMANN' WINGS

"Adding dihedral when flying at high angles of attack effectively adds sweepback to the trailing edge. Therefore, Figure 2, which is similar to the full-size Discus planform, is aerodynamically identical to Figure 1 because of the relatively large amount of dihedral on that aircraft. The dihedral of the wing effectively reduces the forward sweep of the trailing edge on the inner portion of the semispan producing a slightly swept forward trailing edge. Similarly, the dihedral effectively changes the lack of sweep of the trailing edge on the outer portion of the semispan into a slightly swept back trailing edge.

"Sorting out the correct combination of forward sweep on the inner portion of the

Maui F3J participants (kneeling, l to r): Dennis Brittain, Ron Loftin, Matthew Collier, Dale Collier, Jim Martin, Anson Ponce. (Standing, l to r): Craig Luedke, Grey Wick, Dave Phillips, Jim Hartzell, Earl Takabagashi, Kevin Aoki, and Tom Schick. Photo by Bob Morine. At right, slot number 3 in action, searching for lift at 4,000 feet on side of Mt. Haleakala.



Tate Wilford offers Discus 3-view, along with photo of the real bird, showing forward sweep of trailing edge of main wing panels. Trailing edge goes to perpendicular at last tip panel, however.

semispan, aft sweep (if any) on the outer portion of the semispan, and dihedral (or polyhedral) is the kind of challenge that keeps life interesting. —Wil."

ERRATA FOR DECEMBER'S WING DRAWING

In an earlier letter, Wil sent in a couple of corrections for the wing planform which appeared last December. Only one reader besides Wil noted these errors, and I failed to write down his name after our telephone conversation. Apologies to Wil and the sharp modeler.

"Dear Bill, I noticed that the flap and aileron percentages on the drawing of the wing planform in the December '89 *MB* were 17% and 25% of 'C' (root chord). This may confuse some as the percentages were 17% and 25% of *local* chord. The leading edge and trailing edge angles of the outer two panels were adjusted to allow the aileron percentage of local chord to remain constant over the full length of the aileron. —Will Schuemann."

APOLOGY TO LE ROY SATERLEE

Judging from Wil's own "simplest form" definition of a "Schuemann planform," it would appear that Le Roy Saterlee (or anyone) was not in error in his *R/C Report* column when he referred to his rather intricate drawing as a Schuemann wing. I did not say he was in error, but nevertheless, I apologize for any possible accusations which may have been mistakenly inferred by what was written.

Because there were (and still are) so many "Schuemann" wings flying around, my question at the time was whether Wil recognized ANY such planform as being "Schuemann." Apparently, now he does. With his recent recognition, it is no longer presumptuous for anyone to use the name Schuemann who stays within the above stated simplest form definition.

However, perhaps a better term for a wing shape which differs in slight ways from Wil's own precise definition (as published in this December, '89 column) would be "Schuemann variant planform," as Will does acknowledge modeler variations.

DISCUS WINGS DO SWEEP FORWARD

During all this hullabaloo about Schuemann wing shapes back in late November (I think), I got a phone call from Tate Wilford asking for the coordinates for the Selig 4061 airfoil. During this conversation the Discus wing shape came up, wherein Tate asked me if I knew that the Discus' trailing edge sweeps forward, and if so why. I didn't know, so he sent me a factory three-view and a photo he took of a local pilot and his Discus. Sure enough it does sweep forward.

Tate wrote on the back of the photo, "I thought you might be interested in that picture I mentioned on how the Discus wing sweeps forward, whereas the brochure shows nothing."

Well, if you take a straightedge to the brochure's top view, it does show forward sweep in the wings. The photo does seem to dramatize this sweep, however. Also, the same straightedge will reveal about four degrees of dihedral per side in the front view. The on-the-ground photo of the Discus does not seem to show quite this much dihedral, perhaps it comes in under flight load. Perhaps too the water ballast he is obviously carrying (it leaks) weighs down the wings.

Wil's comments above explain why the wings sweep forward.

SCRATCH BUILDER FEEDBACK

In response to my request for feedback from any modeler trying the *official* Schuemann planform, came this letter from O.L. Adcock, of Oak Harbor, Washington.

"Dear Mr. Forrey, In reference to your column in Dec. '89, your correspondence with Wil Schuemann was very interesting. I modified the wing on my Dodgson Camano using the proportions published in *MB* about two years ago, not knowing they were wrong. As it turns out, my span and chord measurements were within 1% of the figures Wil Schuemann gave you. The only error I had was the 7% sweep in the trailing edge. I was very surprised to be that close!

"I've been flying my Schuemann Camano for over a year, and cannot speak highly enough of it. Without access to a wind tunnel, my observations are purely subjective. It appears to have a much better L/D, and it turns much better. The better handling in turns to me was the most significant improvement since it's hard to

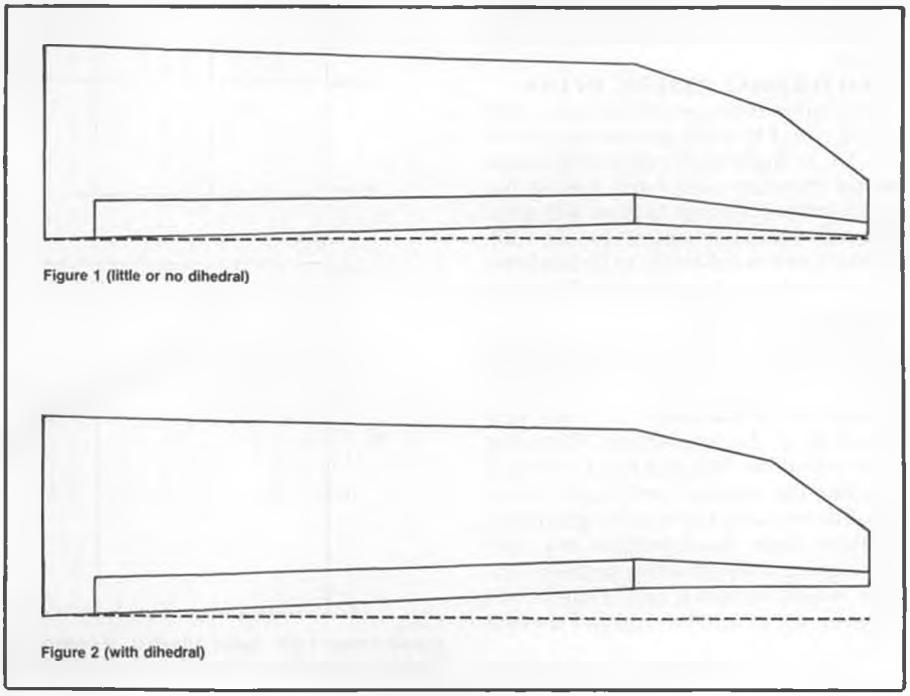


Figure 1 (little or no dihedral)

Figure 2 (with dihedral)

SD7032

1	1.00000	0.00000	17	0.45058	0.08154	33	0.00038	-.00223	49	0.60112	-.00190
2	0.99674	0.00048	18	0.40222	0.08385	34	0.00532	-.00701	50	0.65469	0.00030
3	0.98712	0.00204	19	0.35506	0.08500	35	0.01649	-.01088	51	0.70664	0.00224
4	0.97155	0.00485	20	0.30953	0.08493	36	0.03308	-.01403	52	0.75634	0.00379
5	0.95054	0.00894	21	0.26604	0.08359	37	0.05491	-.01635	53	0.80313	0.00485
6	0.92464	0.01420	22	0.22499	0.08096	38	0.08180	-.01787	54	0.84635	0.00535
7	0.89436	0.02041	23	0.18671	0.07703	39	0.11351	-.01862	55	0.88534	0.00526
8	0.86021	0.02731	24	0.15146	0.07182	40	0.14974	-.01867	56	0.91942	0.00458
9	0.82264	0.03460	25	0.11948	0.06548	41	0.19010	-.01810	57	0.94797	0.00350
10	0.78208	0.04199	26	0.09105	0.05809	42	0.23420	-.01699	58	0.97054	0.00226
11	0.73892	0.04925	27	0.06627	0.04976	43	0.28153	-.01547	59	0.98684	0.00113
12	0.69356	0.05620	28	0.04524	0.04078	44	0.33154	-.01363	60	0.99670	0.00030
13	0.64646	0.06270	29	0.02812	0.03145	45	0.38364	-.01152	61	1.00001	0.00000
14	0.59812	0.06861	30	0.01502	0.02206	46	0.43724	-.00922			
15	0.54902	0.07381	31	0.00606	0.01293	47	0.49176	-.00678			
16	0.49967	0.07816	32	0.00115	0.00448	48	0.54659	-.00430			

thermal without turning! I have not experienced any tip stall tendencies. I used the Eppler 214 without any washout (negative twist) in the tips. I'm not a 'Top Gun' pilot, but this 'Schumano' took second place in Standard and eighth place in F3B at the '89 Nats. I have the same wing on my Dodgson Pixy and won both Two Meter and Unlimited with it last spring at a one day contest with the Torrey Pines Gulls.

"I'm sold on this planform and will now build an Unlimited Class ship with a true Schuemann planform thanks to your column. A 'Schusong?' Thanks for your excellent column. O.L. Adcock."

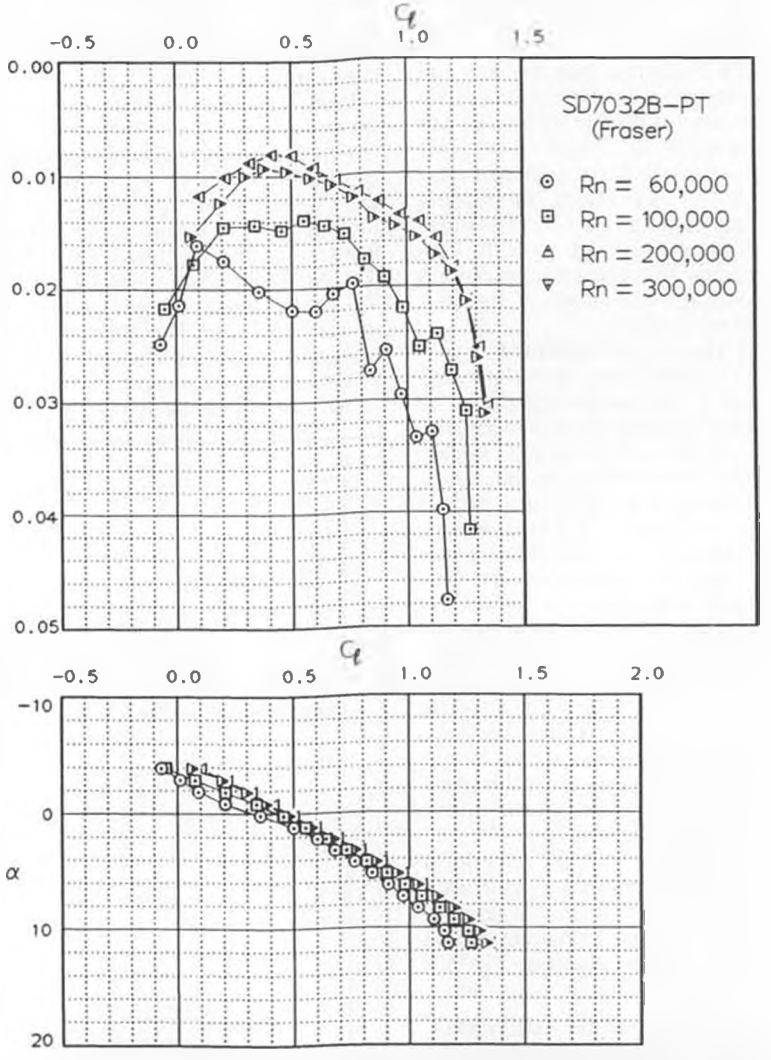
And, thank you. Please let us know how your Schusong turns out, with photos also! P.S., Were you living in Washington when you flew that contest at Torrey in southern California? That must have been some contest!

FAI F3J THERMAL SOARING IN USA

Although it is not an official event with the FAI, yet, F3J is fast gaining support in the USA. In England, this form of time-slot thermal duration with hand towing has been practiced for over 15 years with great success and popular support (unlike F3B). Feedback to this columnist so far has been positive, and in fact at least one F3J event has already been held.

Blaine Beron-Rawdon (the Dynaflite Mirage designer) of Rancho Palos Verdes, California, recently wrote me a letter wherein he commented, ". . . I was very excited about the provisional FAI soaring event with time slots and hand towing. I really like the concept very much. I even think that the hand tow is a very good idea. Has there been much interest in it, and what is going on? Further reports or stimulation would be much appreciated. . . . I may even get to SULA to run an F3J event

Continued on page 85



David Fraser-built, balsa sheeted, Monokote covered wing. PT=Princeton Tunnel; B=Second "model" wing panel tested. A (not shown)=had no Monokote.

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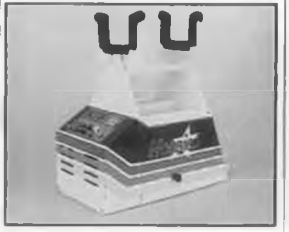

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ALL ABOUT ARFS

By ART STEINBERG

Samanta Emma, newly chosen "Miss Starhawk of 1990," with low-wing Starhawk fun fly entry. Notice the pilot is "Kermit" the frog.

On an intensely bright and sunny day in December, I found myself standing virtually in the shadows of the Superstitious mountains, legendary home of the Lost Dutchman gold mine. What a day! What a place! What an event! The Spook Hills Model Airplane Field, located in Mesa, Arizona, was the place, and the event was the first ever Starhawk Fun Fly. Sponsors of this innovative contest were the Thorpe Engineering Corporation and Exeter Hobbies, and the hosts were a fine flying group, the Arizona Model Aviators. The flying facility was really something we all dream about, a county owned paved field measuring around 400 feet in length and over 100 feet in width. There was plenty of roofing next to the pits to provide shade for those hot summer days, plus spectator grandstands, a spacious snack bar, and all the amenities that go to make a first-rate R/C flying facility.

As Thorpe Engineering is the manufacturer of the Starhawk, a revolutionary new ARF (reported on in the August 1989 issue of this column), the fun fly was open to all

Top pattern flier Chip Hyde wowed the crowd with impressive flying of his YS .60 powered Starhawk.

comers, but those entering and flying a Starhawk ARF were eligible for additional prizes, totalling over $2,500 in value. To sweeten the deal, no entry fee was charged, and amazingly, with little fanfare and publicity, entrants showed up from as far away as Memphis, Tennessee, with one of the most favored contestants being that topnotch international pattern flyer, Chip Hyde. Chip chose to fly one of the low-wing Skyhawk ARFs, and true to form, used a state-of-the-art Futaba PCM competition radio. For power, he installed a Futaba YS .61 side exhaust engine. Though this airplane was originally intended for engines in the .40 displacement range, when I reviewed the model I predicted that a lot of .60 class powerplants would be installed. Chip was one of those who proved me right, and he arrived at the field with a Starhawk he had just whipped together the day before. After one quick test flight, he was ready to compete.

I asked Chip what he thought of his low-wing Starhawk, and he exclaimed, "Well, I didn't know how much I was going to like it at first. You know, the wing is a little bit heavy, but the fuselage is really light. But man, that thing just flies like a dream! It took off and needed virtually no trim, and I just test flew it this morning right before the contest. It flies so good

This Starhawk was jazzed up with rounded fin and rudder, wheelpants, and side-mounted engine.

A high-wing Starhawk attempts to negotiate a low limb pass.

Joe Shaffer displays his rare, early ARF, a 1947 control line "P-51 Fly A-Way."

and is built so straight that during the hands-off flight competition I put it into a loop, activated the fail safe feature on my Futaba PCM radio, and the plane kept looping for a minute and a half without anyone touching the controls until I maxed out the event." (Altitude and heading remained constant during this remarkable display, and the looping could have continued far longer. A.S.) "I think this would be a really good airplane for novice pattern events. I did some maneuvers with it such as stall turns and Immelmans, and the airplane did them very nicely. I'd recommend putting a .60 in it though, if you intended to use it for pattern, maybe something like a K & B or another engine in that class. Man, I love it! I didn't even know if I would continue to fly it after this contest, but that Starhawk is such a great airplane I'm going to go out and fly it all the time!"

There were thirty-eight contestants and the competition was really fierce, starting with the limbo event and ending with the hands-off "chicken" match. Thirteen contestants flew Starhawks, while the rest flew almost every model you can imagine, from

Continued on page 98

Original advertisement offering this all-metal ARF for $75, a hefty price at that time.

Proof that the Starhawk is the "B-17 of ARFS" . . . It keeps on flying in spite of damage. Glenn Helthold with his wounded veteran, damaged just the previous day.

Assistant CD Bob Ruff, CD Terry Borin, and sponsor Doug Thorpe (l to r) of Thorpe Engineering, with the recently introduced Starhawk pattern plane, a beautiful performer.

PLUG SPARKS

By JOHN POND

1. Leroy Brook's seven-foot D.H. Puss Moth, winner at Firs O/T Flying Scale Aeronber Contest. Photo by Jim Alaback.

2. Beautiful all red Fokker D-VIII Astro Cobalt 15 electric power, by Jim Baron. Alaback photo.

3. Ron Falk and his pretty rubber powered Aeronca K from a Comet kit. Photo by Jim Alaback.

Many modelers who are not familiar with the western states, especially California, don't quite understand why there are so many new ideas in SAM cropping up all the time.

A look at the latest 1990 R/C O/T Contest schedule is enough to blow anyone's mind. There are nine major SAM Contests, all in California, before the month of June! This is due to the terrific amount of interest in 13 SAM Chapters and does not count outside states such as Nevada or Arizona. Free Flight is no different, with a minimum of five major two day annuals plus the three-day Memorial Day Annual at Taft.

Because of this ferment of activity, new events are constantly being tried, as witness the extremely popular 1/2A Texaco event that was officially adopted in the SAM Rule Book. This will shortly be followed by the .050 and Class B Electric Events. In the wings waiting on heavier competition is the O/T R/C Soaring Glider event.

So when Bob Munn of SAM 41, the San Diego Aeroneers, proposed an old-timer Flying Scale event with more emphasis on flying than scale, this columnist was quite enthusiastic about the idea.

After an animated club meeting and exchange of ideas, correspondence, and rules, a "First Annual Old-Timer Scale Contest" was conceived. Many thanks to Bob Munn, Leroy Brooks, and Jim Alaback for the meet being organized and scheduled for October 22nd at Alpine, California (east of San Diego).

Although the unexpected earthquake prevented this writer from attending, a full report was received from Alaback in his excellent newsletter, "Aero-News." Contest was on November 5th as the weather on October 22nd was very inclement (windy to you!). The following is excerpted from Jim Alaback's report.

"The San Diego Aeroneers First Old-Time Flying Scale Contest was held on November 5th after two consecutive weekend postponements. The November contest wasn't that much greater with a breezy day that crashed Ron Falk's jumbo rubber powered Aeronca and Ernie Wrisley's Lanzo DH Puss Moth that ended up in a tree.

"Because of the postponements, other outside club contestants were not represented. Some, like John Pond, offered the feeble excuse of an earthquake for not attending. (Ed. Note: It is no joke; flying generally goes on all the time despite tremors.) Seven scale models were present with a preponderance of DH Puss Moths (3) represented by four rubber-powered, two gas, and one electric."

Photo No. 1 shows Leroy (Chief) Brooks with a Pat Sweeney DeHavilland Puss Moth, the plan marketed under Sweeney's Uptown Model Shop in Chicago. This seven foot model was the hit of the meet. Brooks truly scratch built this model starting from a plank and sawing all wood to size! The model was powered by a Merco 49 glow and flew extremely realistic. The model was built and finished in the original aluminum color with black lettering.

4. Larry Oliver produced this excellent version of Earl Stahl's Rearwin Speedster. Photo by Jim Alaback.

5. In 1936. John Targos with Baby Cyclone powered Paul Lindberg Rearwin Speedster, as published in *Popular Aviation*.

6. An elite group of the old Cleveland Balsa Butchers (clockwise from top left): Dick Korda, Al Boroz, Chet Lanzo, and Bert Pond.

Photo No. 2 is an excellent snap of an equally excellent all red Fokker D-8 built by Jim Baron. This Astro Cobalt 15-powered scale model flew excellently. Earl Stahl, the original designer, would have been thrilled to see the performance of this O/T R/C model for realistic, fighter-like performance (loops, spins, etc.).

Jim also provided some other photos we are pleased to present, No. 3 an Aeronca K built by Ron Falk, a jumbo-size rubber-powered model still being kitted by Comet Model Airplane Co. The model started as a K model and was updated to make it a "Chief" version.

Photo No. 4 shows Larry Oliver's Rearwin Speedster as designed by Earl Stahl. This all yellow model not only looked good but flew good as well.

Jim further reports the contest was one of those enjoyable meets with many models exhibiting excellent workmanship. LeRoy Brooks, Contest Director and prime mover of this contest based on proposals by Bob Harrah and Bob Munn, the former providing the plaque before his unfortunate demise. Results:

Rubber

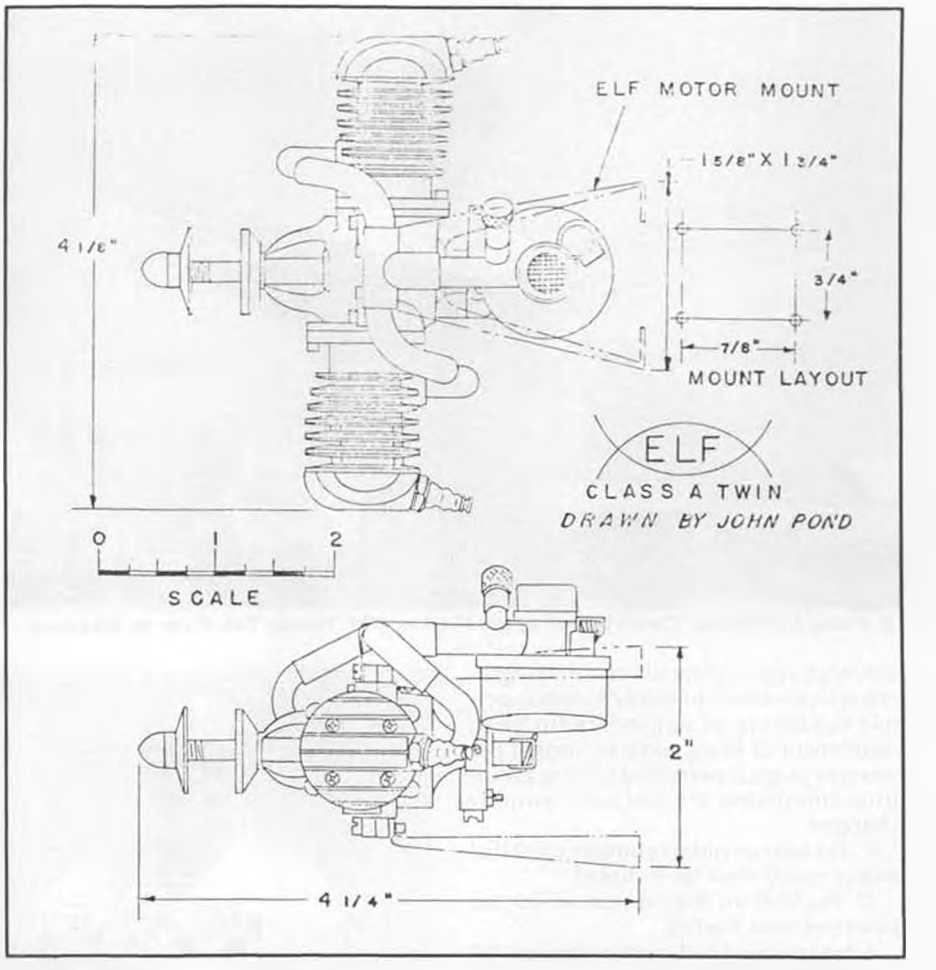
1.	Ernie Wrisley	DH Puss Moth
2.	Larry Oliver	Rearwin Speedster
3.	Jim Alaback	DH Puss Moth
4.	Ron Falk	Aeronca Chief

Electric

1.	Jim Baron	Fokker D8

Gas

1.	Leroy Brooks	DH Puss Moth
2.	Ernie Wrisley	Taylor Cub



Wanna join the fun? Well, here are the rules that were used. It is proposed to employ them on a tentative basis for a year or two until the rules are firm and agreeable to most contestants.

I. GAS-POWERED R/C ASSIST

THE AIRPLANE: Model built from kit or published plans prior to December 31, 1942. Scaling allowed. Original plan may have been for gas or rubber power.

A. Plans or other proof of date of kit or publication should be presented.

B. Dimensions must be as per plan,

7. Still another Lanzo Bomber. This time the best Monokote Finish Award model, built by Bob Bennethom.

8. A rare A-E. Brooke "Comet II" built by Brad Levine, SCIF Texaco, Taft. Photo by Mikkelson.

11. Frank Greene and Lew Mahieu (holding one of his speed record setters), about 1947.

although appropriate structural strengthening is permitted: Internal changes to permit mounting of engine, radio gear, attachment of flying surfaces, linages per modern usage is permitted so long as outline dimension are not substantially changed.

C. No limit on radio controls except that motor cutoff must be included.

D. No limit on engine type or size, no power or area loading.

E. No interior detailing permitted except for simple profile pilot.

F. Airfoil as per original model plan.

SCALE JUDGING: The CD will appoint three contestants, one of whom may be himself, as the scale committee, which will by majority vote rate the aircraft in both static and flight judging. Complexity, use of typical old-timer materials, surface detail and general workmanship will be considered together with any other factors contributing to a realistic appearance.

A. Each aircraft will be awarded a score ranging from a low of one point to a maximum of 33 points. Duplicate points may be awarded although it is desirable to avoid this.

FLIGHT REALISM: The scale committee will judge the aircraft for realism of flight, taking into account the take-off and climb out of the aircraft, and the approach, touchdown, and roll-out.

A. A maximum score of 33 points may be awarded for flight realism.

B. A zero score will be awarded if the aircraft lands outside the cleared landing area, or if it overturns completely, unless this is clearly caused by wind after touchdown.

FLIGHT DURATION: Timing will begin when the wheels leave the ground, and stop when any part of the aircraft touches the ground or any fixed object.

A. Engine run: Power will be cut off 45 seconds after liftoff.

B. Each 10 seconds of flight time will be awarded one point up to a maximum flight duration of 330 seconds (five and one-half minutes, or 33 points). No points will be

9. Our trusty (rusty?) *MB* Editor, Bill Northrop, shows he can also build rubber models that are competitive (but still not finished). Photo by Mik Mikkelson.

10. Good looking Fox 50 powered Powerhouse by Art Grosheider, SAM 1 Newsletter editor.

12. Good looking Lancer 72 by Edmund Bond. Uses four-cycle power.

13. Jim Coffin watches the ignition-converted O.S. 15 intently before launching East Coast SAM Champs.

added or deducted for longer flights.

C. Three attempts are allowed to make two official flights. The flight producing the longest duration counts, even if the realism score for that flight may be lower than it was for the shorter flight.

FINAL SCORING: The scores obtained for scale craftsmanship, longest flight duration and flight realism obtained during the longest flight, shall be added together. Highest point total (out of a possible 99) wins.

II. ELECTRIC-POWERED RC ASSIST

The electric event will follow the same rules as the gas event except that the motor run in the Flight Duration will be 90 seconds. Note that motor speed control may be used.

III. RUBBER-POWERED FREE FLIGHT

The rubber event will be in accordance with the SAM rules. These are given in paragraph 9 of Section I under Basic Event and F/F Rules on page F/F 2 of the 1988-89 Edition of SAM Official Rule Book.

Remember these are not "official" SAM rules and should not be regarded as firm. Jim Alaback has indicated in his latest newsletter, the SAM 41 membership has approved two old time Flying Scale meets for 1990, a spring contest in May and a fall meeting in October.

ENGINE OF THE MONTH

For this month's subject, we are indebted to Gordon Codding, 3724 John L. Avenue, Kingman, Arizona 86401, for the use of his Elk Twin Ignition. This fine specimen languished at the Pond household for nearly a year waiting to be drawn. An urgent call from Gordon quickly resolved the lethargy at the drafting table and we are pleased to present the Class A Elf Twin.

It is worth noting this engine was used by Codding in a controline Victor Stanzel "Baby Shark" back in 1944. Gordon later added a second wing to create a biplane and added "Gee-Bee" type landing gear with Jim Walker U-Control System.

The Elf swung a surprisingly large prop for its displacement and ran very quietly. More than one time Codding said he put his fingers back in the propeller arc for another flip only to find the engine was running! Power was smooth and more than adequate.

"However, I had to remove the engine before it was broken in. The engine is still not run-in. Of all the 19-size engines I have owned, I would say the Elf gave less trouble and was more fun. Maybe it wasn't as good as a McCoy or an Ohlsson, but the engine was perfectly suited for sport/pleasure flying. No troubles experienced; just follow the factory instructions and everything worked perfectly."

To properly describe the engine, it should be noted this is a Elf Class A Twin, Model 20 of 198 cu. in. displacement. The engine was manufactured at Elf Engine Co., 3055 N.E. Everett St., Portland, Oregon. The engine box contained a sheet for registration with the National Motor Registry Bureau, A.M.A., 1025 Connecticut Ave. N.W., Washington 6, D.C. Also included part lists, the serial number, and displacement. On the application form was the following: "Protect yourself in event of theft by registering your engine with A.M.A. Use a separate card for each engine. Notify Washington when you sell, swap, or otherwise dispose of engine or change address. Send three cent stamp for each registration card you need." There is something to be said for this idea!

The engine carburetion was a simple soldered brass assembly with a butterfly valve from the gas tank. Of course, with such an economical running engine, care had to be taken not to over-prime the engine.

Elfs were made from aluminum sand castings, crankcase and cylinder. A thin lightweight steel tubing made up the timer while the steel ringed piston and connecting rod were also aluminum sand castings.

The timer, located in the rear of the engine, consisted of a cast aluminum body with a pressed aluminum cover cap enclosing the timer points. This ran off a crankshaft constructed of solid drill rod fitted with steel counterweights.

Finally, the engine was provided with motor mounts made of steel formed angle bar framework. Other accessories were the factory supplied coil and condenser, weight approximately 2.5 ounces.

Figures for performance are only those supplied by the manufacturer:

Speed: 500-10,000 rpm
Horsepower: 1/2
Displ: .198 cu. in.

Suitable for three- to five-foot models.

50 YEARS AGO, I WAS . . .

John Targos, 3229 Dianora Dr., Palos Verdes, California 90274, writes in to say you can always find something if you are not looking for that particular item. Such is the case of Photo No. 5 showing John with a Rearwin Speedster.

14. John Chadd, Australian RCAS Prexy, seen with Joe McGuffin's Finneran Flyer at Richmond Race Track, N.S.W.

15. Bruce Abell machined up this good-running "Matador" .60 four-cycle engine for his Lackey Zenith.

This particular model was a design by Paul Lindberg, then the Model Editor of *Popular Aviation*. The Rearwin was the first of a series of gas model designs that started in July 1936. Up to this point, Lindberg had produced a flying scale rubber model every month for the *Popular Aviation* modelers.

Lindberg's output, to say the least, was tremendous, with a range of models varying from a seven foot Fairchild 24 to a non-scale three foot triplane. This lasted until early 1940 when WWII broke out. Sad to say, Lindberg never did get back into the magazine plan business again as his kit business prospered to the point where there was little time for anything else.

The Rearwin being held by John Targos was one of the most popular gas models in 1936-37. The model not only looked good (being a scale model) but flew quite well.

16. Jon Fletcher, Australia, displays damaged Pomona Champ fuselage (and expression to match) that was still good enough to win!

This was a godsend as very few of us in the early days knew how to fly a gas model.

When John spotted the Rearwin plan in *Popular Aviation*, he knew he had to build that model for the Baby Cyclone engine he had just purchased. Like all of us in those post-depression days, every nickel and dime came the hard way.

John then approached the art teacher at Patrick Henry Junior High School, New York City, to help draw a set of plans. After weeks of instruction, he came up with a set of full-size plans on white butcher paper. (What else in those days?)

"The model, when finished, flew rather well with one drawback; when landing hard or hitting a low obstruction (bush, etc.) the wings would separate from the fuselage. We fixed that but adjusting gas models was another story! Quite different from rubber models!"

Of note is the Junior Birdmen wings with bar on the lapel of John's jacket. These were quite the deal in their day as this writer remembers qualifying for all three: Eagle, Ace, and Commander. Not too many got the "Ace" bar as this was earned by placing in the Junior Birdmen eliminations.

CHET LANZO O.M.T.

Every so often, we get what is referred to as a "Classic Photo." Bucky Walter, of SAM 39, sent in Photo No. 6 showing: Bert Pond (front); Chet Lanzo (rear), Dick Korda and Al Boroz.

When the SAM Hall of Fame awards were given out at the Nevada SAM Champs, Joe Elgin picked up Dick Korda's award. Dick was so pleased he gave the tintype photo to Joe who in turn reworked the old tin plate until a suitable photo was obtained.

Elgin seems to think that Dick and Chester were about 19 or 20 years old then in 1934. We don't have the details for the occasion of the photo, but perhaps old buddy, Bertram Pond, can shed some light.

Lanzo's widow, Peggy, told Bucky just about every member of the old Balsa Butchers Club of Cleveland, Ohio, had a nickname. Korda was "Moose," no doubt due to his long chin, and Lanzo was called "Ace," a rather obvious title.

EDITORIAL (OR GRIPE?)

Ever since the Lanzo Bomber was approved as an Antique, this particular design has dominated the competition to the point where this writer has felt compelled to suggest we either handicap this design or put up a special event for it.

It can be pointed out that the same thing has happened to Playboys. This columnist

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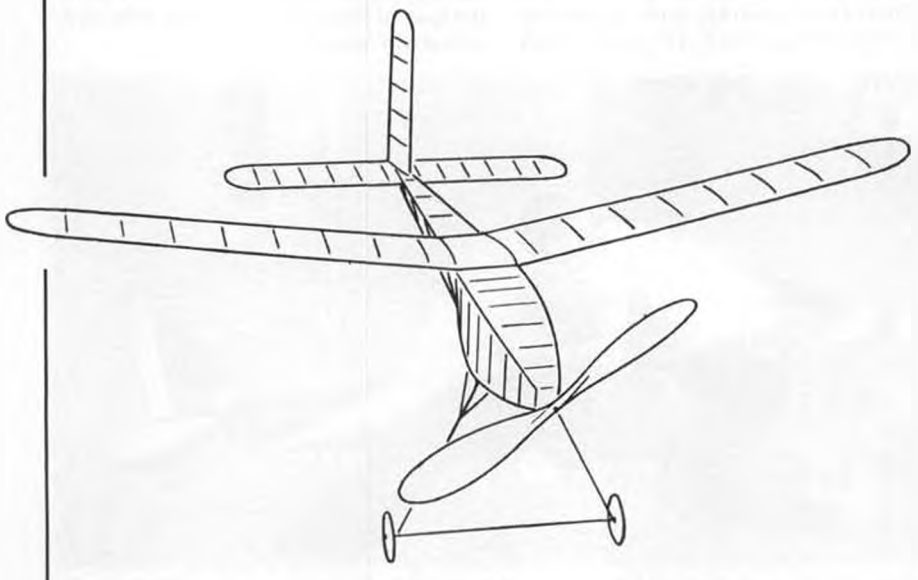


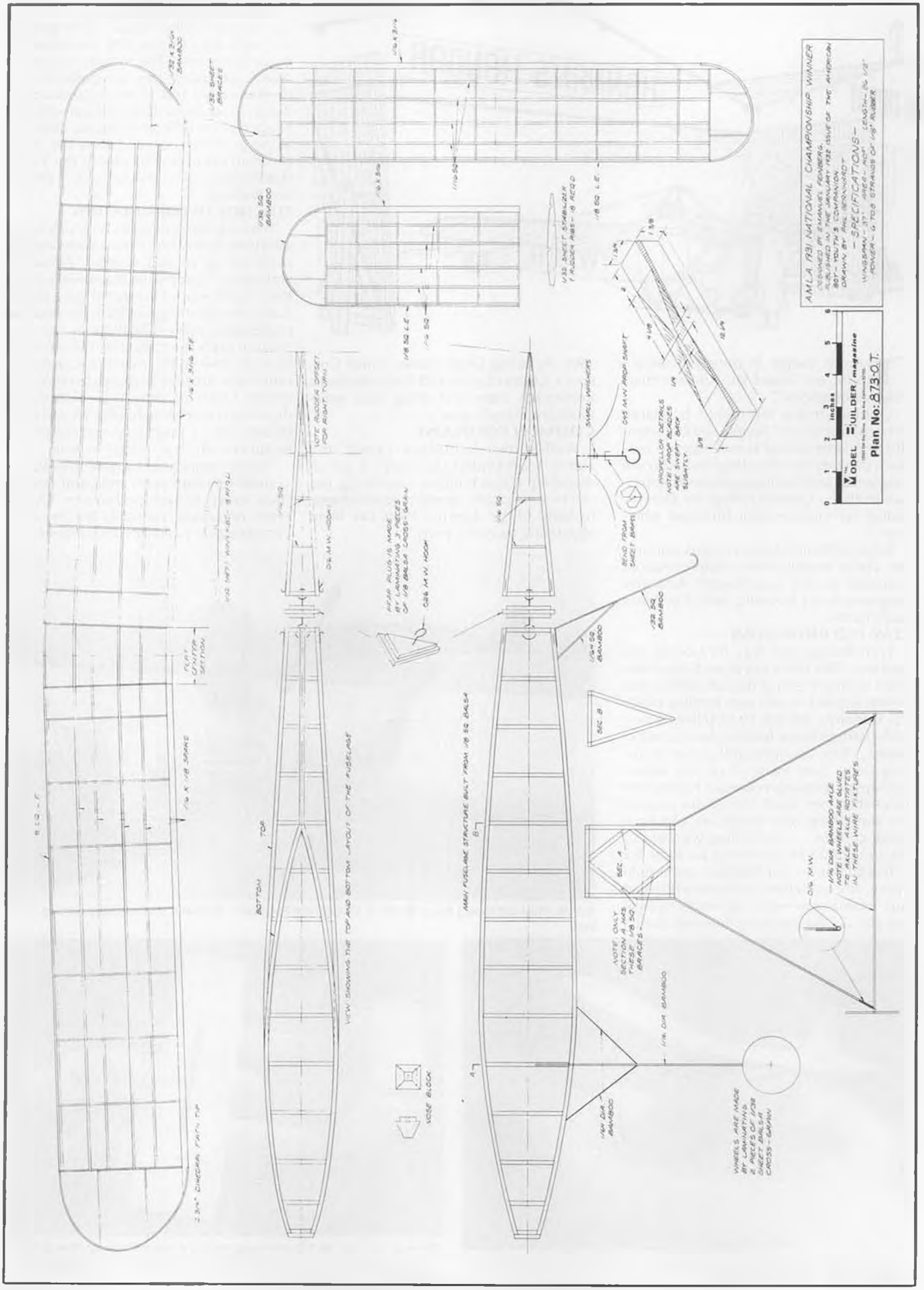
Old Timer of the Month

FIENBURG'S 1931 RECORD HOLDER

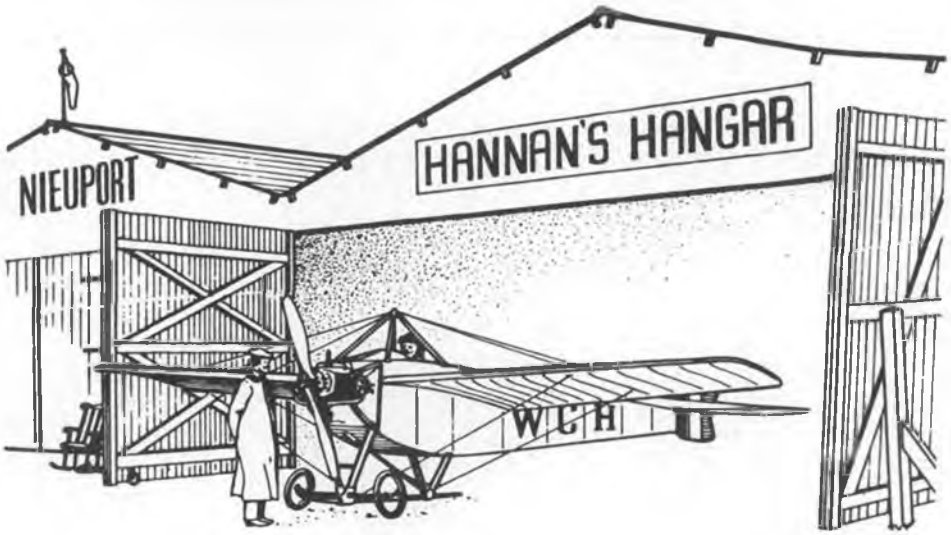
When you compare it with other models of the time, this design by Emanuel Feinburg of Detroit, Michigan, was quite advanced. It won the 1931 National A.M.L.A. meet in Dayton, Ohio with a flight of 29 minutes and 30 seconds, setting a then new world record.

Plans, and an article describing the construction of this model, were published in the January 1932 issue of *The American Boy - Youth's Companion*. It was called to our attention by Bob "Satellite" Hunter.

Of special interest is the "locked axle" landing gear arrangement; still a great idea for improved ground handling of taildragger designs, particularly on those cantankerous WW-I scale R/C ships!



FULL-SIZE PLANS AVAILABLE-SEE PAGE 106



"There is danger in using equations if these are based on fundamentally false assumptions."

Our lead-in line this month, by Martin Simons, continues: "People without scientific or mathematical knowledge are mislead, thinking that the clever folk who use long words and formulae possess a mysterious truth . . . Understanding the facts requires no mathematical formulae whatever."

Extracted from Martin's remarkable article about aerodynamic misinformation, featured in the July-August *Airborne* magazine from Australia, edited by Merv Buckmaster.

YEAR-END REFLECTIONS

Even though you may be reading this well into 1990, these words are being compiled during the final days of 1989, a year which seemed to pass with startling rapidity. Certainly we live in turbulent times, with changes in our families, homes, workplaces, cities, countries and planet occurring faster than many of us can follow. Perhaps we can appreciate our hobby time more than ever now? At least our projects are something over which we can have some control . . . something we *want* to do, in contrast to something we *must* do.

In addition to our hobbies, we should appreciate our fellow *hobbyists* who share our enthusiasm—they are truly special people. . . . We lost some fine ones during 1989, including Dusty Carter, Vince Costanzo, Chester Lanzo, and Andy MacIsaac. Remember them and enjoy your aeromodeling friends *now*.

COMMON COMPLAINT

Well-known lightplane expert and author John Underwood says: "I got all stirred-up about building something, but can't seem to make up my mind which one to build of the dozens of kits I've been squirreling away for years."

NO JUNIOR PROBLEM!

Regarding the shortage of youngsters in our favorite hobby, "Cyano de Bergerac," writing in the October 1989 *Aeromodeller* magazine notes: "The reasons why youth rejects aeromodelling are perfectly understandable, and mostly undefeatable. But let us pause for thought inspired by the Hippersonian reflection that we might do as the politicians do, and solve the entire problem on paper, by raising the Junior threshold to admit 55-year olds!" Thanks Jim Alaback. . . .

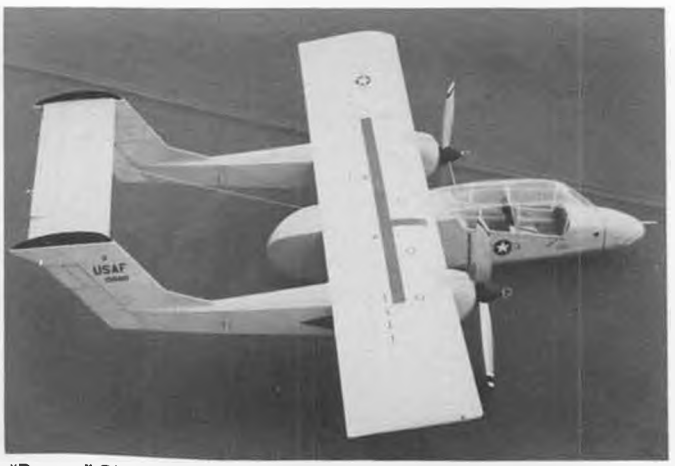
FUN, NOT OVERREGULATION

Why are some contests so much more satisfying than others? The answer may be summed up in two words: "Favorable ambiance." Some have it, some don't. As Ron Moulton put it in reporting the World Scale Championships of 1970: "Impossible to describe, even difficult to say that one could actually see it, was the truly wonderful scale spirit of this meeting. Communication was above all language barriers, and within hours of arrival, a relationship developed that brought officials and contestants into a great help-each-other atmosphere which is unique to Scale.

"Some competitions appear to welcome competitors with open arms, and cater to their every known preference. Others seem organized primarily for the convenience of the officials. The difference is

R.O.H. (Rise Off Hand) Waco Model E, by Graham Fergusun, Australia, on its bumpy runway. See text.

Dave Livesay, typical happy contestant at a Flying Aces event, with his Jumbo Scale Focke-Wulf TA-152.



"Bronco" OV10A, 26-1/2-inch span rubber powered twin by Jane Schlosberg averages 40 seconds. Beat Bronco by original model designer, Dick Howard.

instantly recognized, and permeates all of the proceedings. As one highly-regarded model builder remarked after attending two major contests in close succession: One was like a full-course banquet, the other like a wilted salad."

Among the newest of contest-holders, the *Northwest Scale Watch* group deserves some emulation. Their recent meet held in Snohomish, Washington, attracted some 71 scale models—and rave reviews from the contestants. Why? "The philosophy of FUN and Enjoyment coupled with gentle rules and meet design, along with superb flying and dining facilities. . . ." Indeed, ambiance is everything.

BOGUS SCALE

Meanwhile in the *other* Washington (D.C., that is), the *Maxecuters* club has a longstanding reputation for satisfaction-filled contests with innovative events. Newest is a Bert Phillips proposed competition he calls "Bogus Scale." Based upon existing Bostonian rules, it includes the provision that the model must represent some particular full-size aircraft to somebody besides its builder. Which means, for example, that if the subject, such as the

Close-up of gem-like Stefan Gasparin CO_2 engine in Lacey. Photo by Michal Gasparin.

Spirit of St. Louis did not have a windshield, why should the model? Bert has even offered to serve as judge, explaining that if only three models appear, the event will still be held. First prize? "A pat on the back."

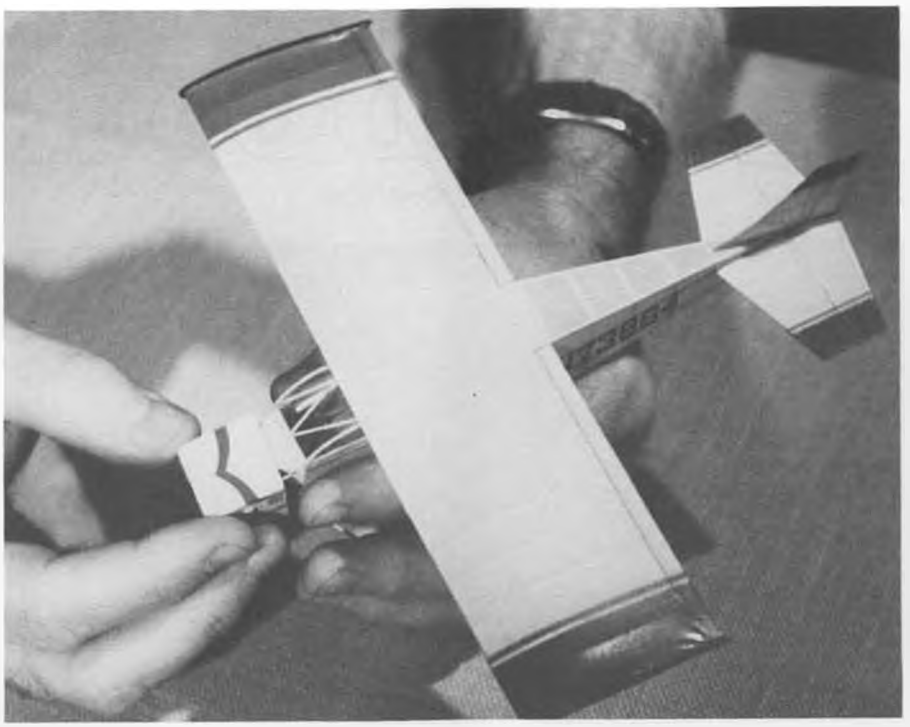
SPEAKING OF CONTESTS

Charming Jane Schlosberg, of Arizona, must certainly be among the most avid free flight scale competitors we know. During a recent Flightmaster meet at Mile Square Park near Los Angeles, Jane finally managed to best the "King of rubber-powered twins," Dick Howard. Not only that, she did it with one of his own designs, the OV10A "Bronco" shown in one of our photos. Dick's reaction to the trouncing? "The King is dead, long live the Queen!"

BEWARE THE BIRDS

Dick Howard also shared a letter he had received from college professor Bruce Holbrook. Bruce does his model flying near an animal preserve where two varieties of falcons, ranging in size from two to four-foot wing span circle almost continuously overhead. In Bruce's own words: "I was in the middle of what promised to be my longest flight to date, with my Peanut Prest Pursuit, (when) I heard what sounded like a pistol-shot and the model's tail snaps off. Next to it, a falcon pulls out of his dive, as tail and remainder of the plane, at different speeds, twist groundward.

"The styrofoam pilot's eyes remain wide with shock. Mine too!"



Cowling slides forward on Frantisek Barta's Pistachio Lacey M-10 for easy access to its CO_2 engine. Photo by Michal Gasparin.

HOW TRUE, HOW TRUE

Dan Walton, of Kansas, while finishing a scale model, remarked: ". . . it's all the little stuff that takes the time and is not noticeable."

R.O.H., ANYONE?

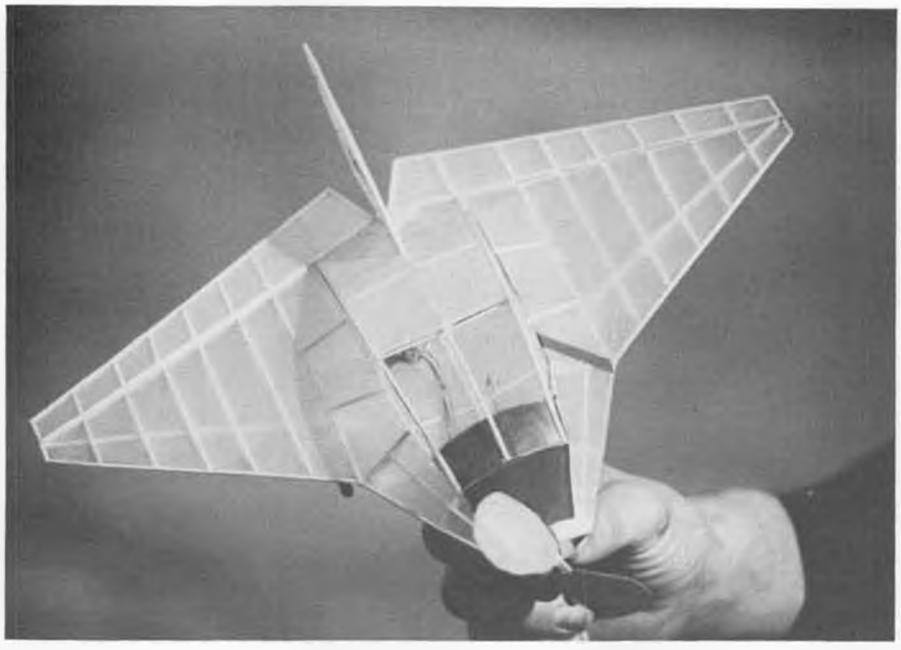
R.O.G. (Rise Off Ground), R.O.W. (Rise Off Water) are fairly standard abbreviations among modelers worldwide. But R.O.H? Graham Ferguson, of Australia, explains that years ago he saw a photo of a small scale model rising off its builder's hand, and determined to duplicate the feat himself. His first try, a 6-5/8 inch span Aeronca, proved too heavy. His next test model, a 1/72nd scale all-balsa Tiger Moth flew OK, however would not rise from his hand. It met an untimely demise by gliding into a hot fireplace.

Continued on page 90

Full-size vintage monoplane on display in the Budapest, Hungary Hilton Hotel, photo by Elisabet Ballin. Can anyone identify the aeroplane?

INDOOR

By KEN JOHNSON



Dyke Delta JD-2, condenser paper covered Peanut scale by Chris Johnson, of Los Angeles, CA.

After a three-year absence your original indoor editor is back. Some friends have asked what I've been up to during that time. The truth is that competitive dance roller skating and choral singing took up much of my time, with some time involved in sailing and oil painting. Now I'm rested and ready to write the column again. So let's go!

OLD-TIMER INDOOR

Many of the younger modelers or older people just coming into the hobby may have missed old-timer models. Old-timer models are those designed and built before December, 1942. They could be outdoor types, gas, rubber powered, or indoor scale.

Model Builder ran an article in August, 1979 on AIR XX (20) models. This editor and Mik Mikkelson came up with the idea of an indoor contest for replicas of old-timer models. The article in *Model Builder* pictured various models built and flown in the contest held at Paul Revere School in Santa Monica, California. The span of these models was limited to 20 inches. I don't know if any other groups of indoor modelers built AIR XX. Perhaps if I had offered a plan kit for these little beauties some more interest would have been shown. Write to me if you are interested in four or five plans. An interesting club contest project. Incidentally, AIR XX stands for Antique Indoor Rubber 20-inch span. We felt that with the high aspect ratio wings on many of the old-timer models a 20-inch span was the minimum we wanted to build. However, recently, while at a local Blacksheep flying session, I noticed that Bob DeShields and friends were flying Grapenut (8-inch span) all-sheet old-timer replicas of gas models. They flew really SUPER!

MAKING ROUNDED TIPS

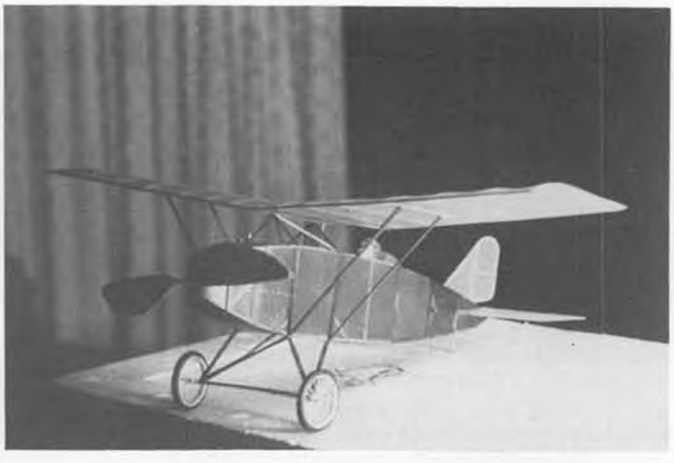
Most airplanes have rounded tips on the wings, stabilizer and vertical fin. Forming these curves is sometimes a problem. Many modelers cut the curves out of sheet balsa. If you are building from a kit, the curves are printed on sheet wood so there is no hassle. However, these tips are almost always too heavy. Added airframe weight is not a good thing for indoor models, so I am always seeking ways to make my models lighter.

These indoor models fly longer and slower, and that is good! Print wood in kits is always heavier, so it is smart to select the lighter wood at your hobby shop and use this instead. The best way to transfer the tip curve outline from the plan to the sheet wood is as follows: Slide the lighter sheet wood under your plan, making sure the grain in the wood is going in the correct direction. Then select a straight pin,or better still, a push pin (with the plastic or metal top), and begin at the edge of the curve to pierce through the plan and into the sheet wood. Begin at a point on the plan before the curve begins. A pin hole about every 1/8-inch is the correct way. As you come to the end of the curve, continue for about an inch beyond. Be sure to pinhole both the inner and outer arcs of the curve. When finished, simply slide the wood from under the plan and cut along the dots with a knife or razor blade.

The type of tips I prefer are those laminated from thin strips of balsa. If you have a balsa stripper, these are easily cut to uniform size. A metal ruler will also work to make the strips.

When pin-holing through the plan, I slide illustration board (from the art supply store) under the plan. Crescent 201 cold press illustration board is my choice. Only the inner arc of the curve is pin-holed on this. Then I sand the cardboard curve after it is cut out with large scissors. After the curve is sanded round and smooth the strips are first soaked in warm water then taped to the form. The first strip is wrapped around and taped at each end. Keep light tension on the strip as you pull it around the form. Then a Q-Tip is soaked with thinned Elmer's glue and run along the outside of the first strip. The second strip is

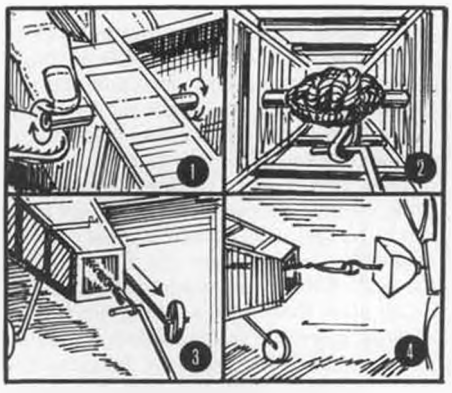
Nicely built Phalz WWI biplane by Eric Erickson of Pasadena, CA. This Peanut flew for 49 seconds.



Twenty-inch span indoor scale Waterman racer built by Frank Baria, of St. Albans, West Virginia.

Christopher Bird, who seems to favor biplanes, and lots of them, readies his Curtiss Jenny for indoor competition.

Addie Naccarato helping Misty Sue Mehmen with her Bell P-59 Air Comet Catapult Jet scale.



RETRIEVING A RUBBER MOTOR

When the rubber motor slips off the propeller shaft hook and balls up at the rear pin, try this.

1. Rotate the tubular pin toward the front, then the rear. This should make the rubber knot open up enough to expose the open loop.
2. Insert a 12" length of .030 music wire (with a right angle bend 3/8" from one end) into the front end of the open fuselage. Pass the right angle bend through the open rubber loop.
3. Slowly pull the wire (with rubber loop) out of the fuselage. Allow the wire to rotate slowly as the motor begins to unwind.
4. Then simply reattach the loop of rubber to the prop shaft hook at rear of the nose block.

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taped over the first strip and glue is added to this strip. Repeat for the third strip. Be careful not to get any of the glue on the edge of the cardboard template. Then bake the assembly in a warm oven or simply allow to air dry for several hours. Last, carefully cut the wood away from the cardboard with a very thin, narrow blade. Sand smooth and round the outer edges. The wood grain follows the curve of the tip and is strong, yet light.

EXIT CONDENSER PAPER

The latest word from Jerry, at Micro-X Indoor Products, is that there will be no more condenser paper. At least for now. It appears that this indoor covering material is no longer being produced. Word of this situation surfaced when I tried to purchase several sheets at my favorite hobby shop. One of the modelers noted that it is not being used for duration models now as the old paper stick class now allows the use of plastic film covering. Duration fliers prefer plastic because there is no shrinkage problem (as there is with condenser paper). However, there *is* an important need for condenser paper. The peanut and scale indoor builders dye the paper and cover their models with it. There has long been a penalty associated with tissue-covered aircraft. Since a Japanese tissue-covered model is heavier, it will fly a shorter time. It will also fly faster and must be structurally stronger. Heavier scale-type aircraft belong outdoors. Or, so thinks this builder. I, for one am very sad to see condenser paper disappear. How do you feel?

PROFILE SCALE

At a recent indoor contest profile scale was flown. The rules stated that condenser paper was not allowed, so I covered my Brown racer with light tissue instead. The winning model was covered with Micro-lite plastic film coated with enamel spray paint. The builder revealed that this film is heavier than condenser paper but lighter than tissue. Could this be a new indoor covering material for the future?

HORIZONTAL CENTER OF GRAVITY

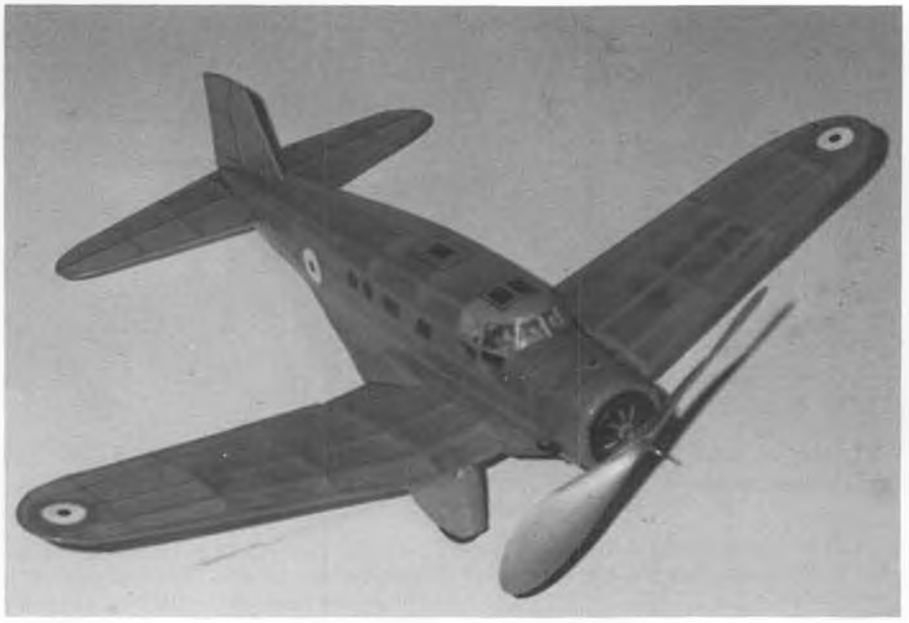
Have you noticed that your Peanut or larger scale model will tend to fly toward the side with the heavier wing?

You can determine which side of your model is heavier by removing the nose block and rubber motor then inserting a round pencil or long dowel into the nose of the plane. This should be done when the aircraft is upside down. Watch to see which wing tip drops. If the one wing is too heavy, your craft may turn too tight. If your plane does not climb, the tight turn may be holding it down. This condition occurred

Continued on page 105

Shirley Baxter launches Japanese kitted ornithopter at L.A. Marine Corp. Armory.

Indoor flying at Luther Burbank school gym. Von Whitlock launches low wing Peanut.



VICKERS DELTA

By WALT MOONEY

A simple, low-wing Peanut version of a familiar Northrop Delta design that saw much service in Canada in the 30s and 40s

In the search for a design to enter in the World War II class at the 1989 Nagoya Nuts Postal Proxy Peanut contest, a Three-View for this relatively obscure Patrol Bomber was found. The model was third in its class at the contest so the effort of building was rewarded.

The Canadian Vickers Aircraft firm obtained a license to build the Northrop "Delta" design in 1936, and several of this type on wheels, skis, or floats were used as Patrol Bombers during 1940. The aircraft were later relegated to training duties.

The model was built to be disassembled for shipping and was fitted into a fairly standard balsa 4 x 9-1/2 x 2-1/4-inch box. See the previous article on the ITOH 62-160, describing a box which cost only $4.32 to mail by Airmail to Japan. It came back from Japan in the same box, completely undamaged.

The plan published here is Peanut Scale and the larger plan was simply reproduced at twice size. As a consequence, all the sizes called out are half size for the large airplane. This should not present a problem, as any model builder can multiply by two. Actually, parts cut out of sheet balsa, for instance wing ribs and formers, could be cut out of the same thickness balsa without any trouble.

The Peanut flew fine on a single loop of one-eighth rubber and the twice-size could do well with two loops of three-sixteenths.

The skeleton photos show the structure, and how it has to be made for disassembly for shipping, and as only fairly experienced model builders are likely to want to try this, those details will be ignored in this article. Besides, experienced model builders probably only use the plans as a basic guide inserting their techniques and improvements into any project.

So, building description will be for a model that is expected to be permanently assembled when completed.

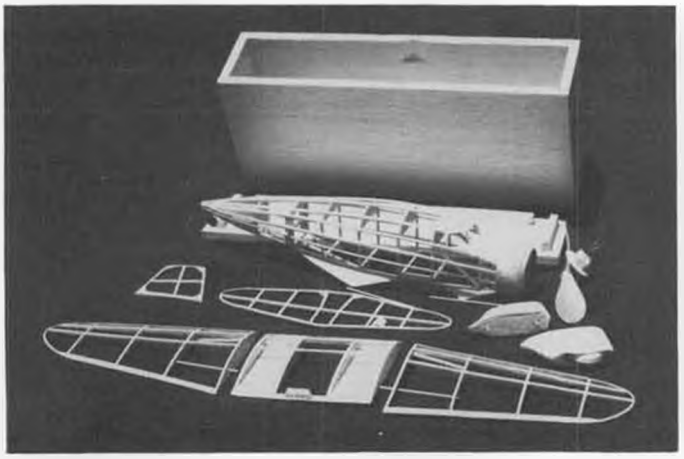
Start by putting a piece of waxed paper over your plans to keep the parts from sticking to the plans as the structure is assembled.

The fuselage side frames are constructed directly over the plan. The frame is shown hatched for emphasis. Pin the top and bottom longerons in place on the plan with straight pins, not through, but on each side of the balsa. Note that the frames go clear forward to the forward cowl pieces. Now carefully cut the uprights and cement them in place between the longerons. Two side frames are required so either build them directly on top of each other, or, at least cut out two of each upright at the same time, to be sure the two frames will turn out to be identical. When the glue used in assembly is dry remove the frames from the plan. If they were made simultaneously, separate them with a thin, sharp blade.

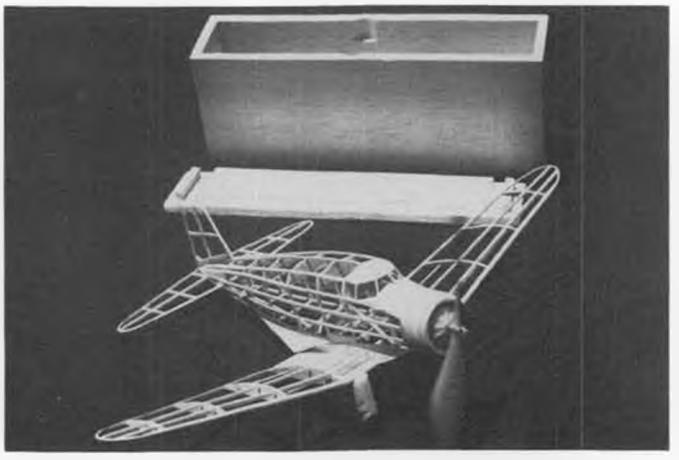
Now, assemble the two side frames into a conventional fuselage box. Because this box does not come together in a knife edge at the back end, there is a solid pointed fairing at the very end, getting proper alignment of the two sides is difficult without a kind of assembly jig.

The sides, top, and bottom of the fuselage box are parallel from F1 to F3. Using any old sheet balsa you have available, make an exactly square cornered, rectangular box, the height of the fuselage box and to its inside width. This becomes the assembly jig. Temporarily attach the side frames to this box, masking tape will work OK, making sure they are precisely located for the same fore and aft location and are exactly in line.

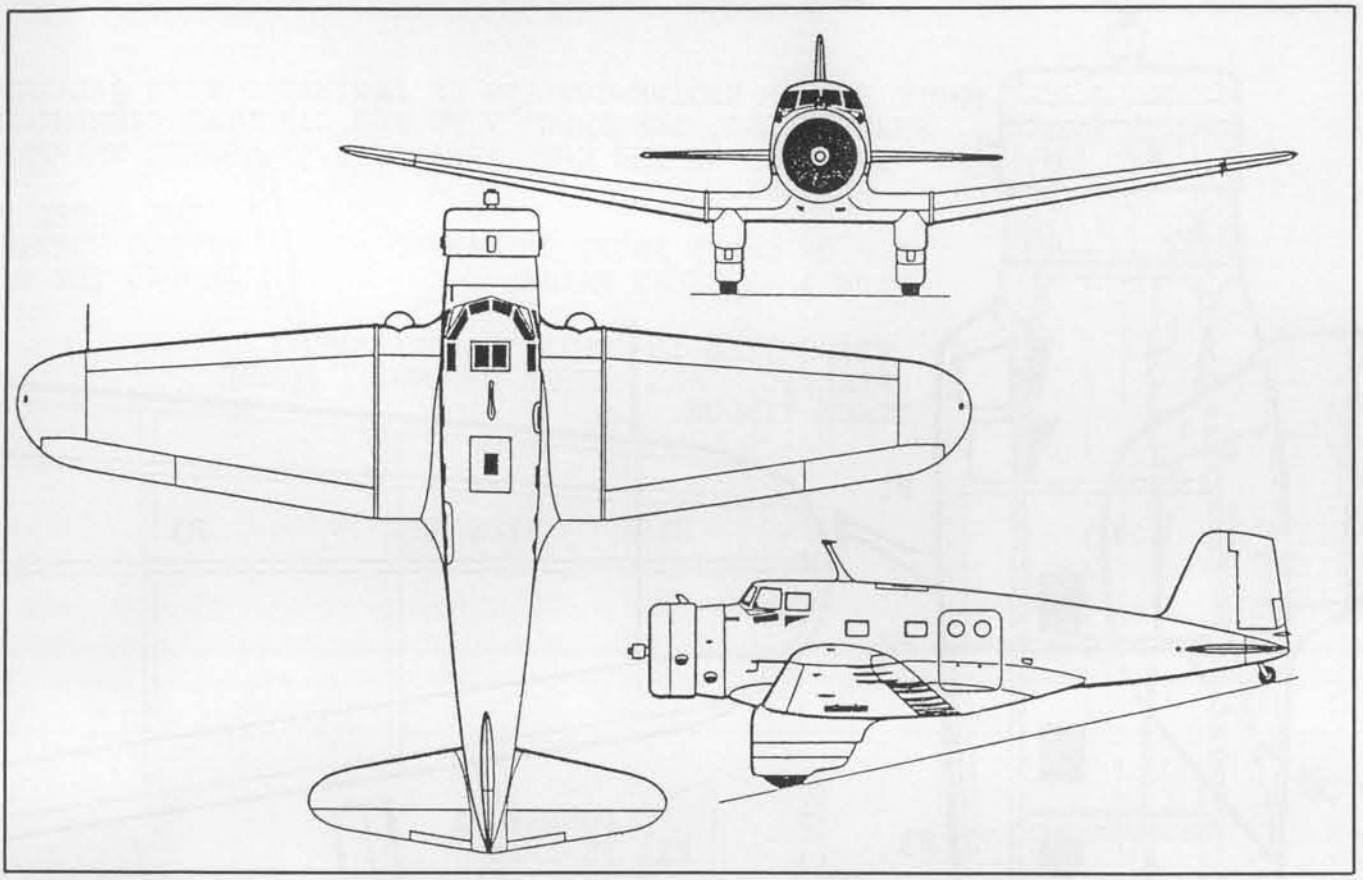
Now, cut out all the cross pieces and cement them in place, pulling the frames



The Vickers Delta framework all broken down to fit in the 2-1/4 x 4 x 9-1/2-inch shipping box.



And here's the Vickers/Northrop Delta minus its yellow tissue covering and military marking. Placed third in class at Japanese contest.



CANADIAN VICKERS (NORTHROP) DELTA II

closer together at the nose and tail as indicated in the top view. When this is completely dry, the jig can be removed, and the cross pieces from F1 to F3 can be installed.

Cut out the fuselage formers. The formers at the cowl are arcs of a circle as shown by the dotted lines in the front view. Cement them in place on the fuselage. Use thin sheet balsa to fill in the last bay of the fuselage sides leaving a slot for the horizontal tail. Now add the stringers to fill out the body contours. There are three stringers on the top, two on each side, and a single stringer on the bottom.

Make the front part of the cowl, and cut an opening to fit the thrust bearing. Wrap the sheet balsa around the front formers. Now cement the front of the cowl to the front of the fuselage box and carve and sand it to the contours shown in the top and side views. Carve the tail cone from block balsa and cement it in place. Cut a slot through it to allow for the horizontal tail.

The horizontal and vertical tail are built directly over the plan. When dry, they are removed from the plan and the leading edges and tips rounded with sandpaper and the trailing edges tapered to a near knife edge.

The wing is built next. It too, is assembled directly over the plan. Cut out the wing ribs. Pin the leading and trailing edges down on the plan. Make the wing tips and cement them in place. Cement the ribs in place. Wait until the cement is completely dry and then separate the outer panels from the plan surface while keeping the center section in place. Block up the tips to the dihedral angle shown in the front view and cement the joints in the leading and trailing edges, and then install the wing spars. When this assembly is dry, remove it from the plan and, using sandpaper, round the leading edge and tips, and taper the trailing edge to obtain the airfoil section shown in the rib layouts.

The landing gear fairings are the last major structures to be made. Their surface on the real airplane appeared layered because they telescoped with the shock absorber deflection of the landing gear. On the model they are simulated by wrapping three layers of sheet balsa, of proper height each, around the fairing former. Use some soft "A" grain 1/32nd sheet balsa for this job. The grain should run up and down the fairing, not lengthwise. Sand the balsa sheet smooth and a bit thinner before cutting out the pieces. Cover each layer with masking tape while bending it around the former. This will prevent the balsa from splitting when it is bent around the front of the former. When each layer is dry, remove the masking tape and cement the next layer in place. When the total assembly is dry, sand the fairings so the contour is correct at the front ends, (a little smoother than the rest of the fairing).

Using 1/32nd sheet balsa, fill in the bottom wing surface between the R4 ribs to provide support for the landing gear fairings.

Before covering the model, make a temporary assembly of all the components to check for proper alignment. In the case of the tail, the horizontal can be simply slid in place, and the vertical merely placed on top of the center stringer to check for fit of the bottom of the fin and stringer. In the case of the wing, however, the job is a little more complicated. There is a rectangular balsa support piece, the width of the fuselage box, that must be made to support the trailing edge so the wing has the proper angle of incidence and another that must be made to support the leading edge. Then bond paper or sheet balsa wing fillets must be made and fitted temporarily. Also, the top and front ends of the wheel fairings must be fitted to the wing.

Once this temporary assembly is satisfactory, disassemble the parts and using fine sandpaper and a gentle touch, sand all the parts smooth and as fuzz-free as possible.

Now cover the model using lightweight tissue. The model in the photos was yellow all over with British roundels and black numbers on the bottom of both outboard wing panels. All windows except the six windshield panels were simulated with black tissue.

Make balsa wheels and paint them flat black. Details such as the carburetor intake, exhausts, etc., are made from scrap balsa. Control surface outlines were drawn in with a fine-point felt pen.

The model should balance in a horizontal attitude supported at the tips of the wing at a point half way between the spars.

Both wings should have about 1/8-inch of washout in each outer panel. The center section should be straight, without any twist. •

CANADIAN VICKERS (NORTHROP) DELTA II

FRONT END OF ENGINE COWLING IS LAMINATED WITH 3 LAYERS OF 3/32 SHEET BALSA, SEE FRONT VIEW FOR CIRCULAR DIMENSIONS. THE REST OF THE COWL AREA IS 1/32 SHEET WRAPPED AROUND FORMERS.

TOP OF CABIN FRONT IS CARVED FROM 3/32 SHEET BALSA.

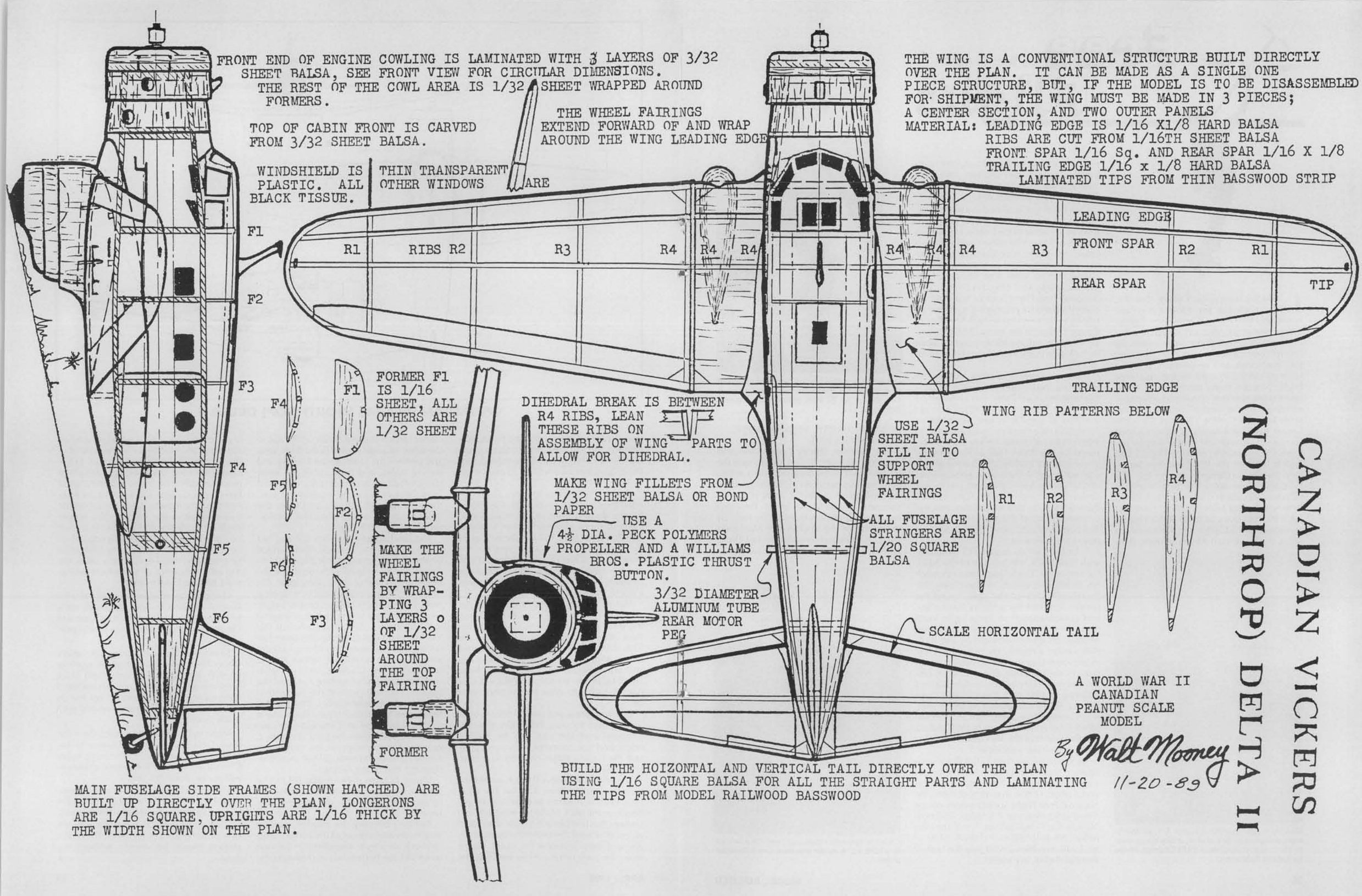
WINDSHIELD IS PLASTIC. ALL BLACK TISSUE.

THIN TRANSPARENT OTHER WINDOWS ARE

THE WHEEL FAIRINGS EXTEND FORWARD OF AND WRAP AROUND THE WING LEADING EDGE

THE WING IS A CONVENTIONAL STRUCTURE BUILT DIRECTLY OVER THE PLAN. IT CAN BE MADE AS A SINGLE ONE PIECE STRUCTURE, BUT, IF THE MODEL IS TO BE DISASSEMBLED FOR SHIPMENT, THE WING MUST BE MADE IN 3 PIECES; A CENTER SECTION, AND TWO OUTER PANELS

MATERIAL: LEADING EDGE IS 1/16 X1/8 HARD BALSA
RIBS ARE CUT FROM 1/16TH SHEET BALSA
FRONT SPAR 1/16 Sq. AND REAR SPAR 1/16 X 1/8
TRAILING EDGE 1/16 x 1/8 HARD BALSA
LAMINATED TIPS FROM THIN BASSWOOD STRIP



FORMER F1 IS 1/16 SHEET, ALL OTHERS ARE 1/32 SHEET

DIHEDRAL BREAK IS BETWEEN R4 RIBS, LEAN THESE RIBS ON ASSEMBLY OF WING PARTS TO ALLOW FOR DIHEDRAL.

MAKE WING FILLETS FROM 1/32 SHEET BALSA OR BOND PAPER

USE A 4½ DIA. PECK POLYMERS PROPELLER AND A WILLIAMS BROS. PLASTIC THRUST BUTTON.

3/32 DIAMETER ALUMINUM TUBE REAR MOTOR PEG

MAKE THE WHEEL FAIRINGS BY WRAPPING 3 LAYERS OF 1/32 SHEET AROUND THE TOP FAIRING FORMER

USE 1/32 SHEET BALSA FILL IN TO SUPPORT WHEEL FAIRINGS

ALL FUSELAGE STRINGERS ARE 1/20 SQUARE BALSA

WING RIB PATTERNS BELOW

SCALE HORIZONTAL TAIL

MAIN FUSELAGE SIDE FRAMES (SHOWN HATCHED) ARE BUILT UP DIRECTLY OVER THE PLAN. LONGERONS ARE 1/16 SQUARE, UPRIGHTS ARE 1/16 THICK BY THE WIDTH SHOWN ON THE PLAN.

BUILD THE HOIZONTAL AND VERTICAL TAIL DIRECTLY OVER THE PLAN USING 1/16 SQUARE BALSA FOR ALL THE STRAIGHT PARTS AND LAMINATING THE TIPS FROM MODEL RAILWOOD BASSWOOD

A WORLD WAR II CANADIAN PEANUT SCALE MODEL

By Walt Mooney 11-20-89

Free Flight

By BOB STALICK

In 1964 the team of Dick Black, then the VTO columnist for *Model Airplane News*, and Carl Fries, an active free flighter from Crestwood, Missouri, began discussing a national free flight organization via voluminous correspondence and through the magazines and newsletters. It was a labor of love . . . love for the future of Free Flight. Not too many months later, these two tireless workers convinced a number of others of the possibilities of forming such an organization. And in 1965 the dream became a reality as others joined the cause: George and Dotty Murphy became the first editors of "Free Flight," Bob Stalick became the first Executive Secretary, Hardy Brodersen became the first Executive Treasurer. The first board of directors included: Carl Fries, Dick Black, Pete Sotich, and John Worth . . . yes, that John Worth! Dues were $5.00 for charter members and $3.50 for regular memberships, if you were an AMA member. With only a little basic arithmetic, anyone reading this column can subtract 1965 from 1990 and see that the National Free Flight Society is now 25 years old.

Charles Neely flew this Simplex A/1, an MB 3-view, designed by Bob Stalick, at Sky Kings meet in '89. Combo placed 3rd at '89 FF Champs. Photo by Leland Schroeder.

Dick Black was confined to a wheelchair during his life, but that didn't keep him from being active in the hobby. His models were proxy flown by others, and were immaculately made. His columns showed remarkable insight and gave many of us a connection to other free flighters. Dick passed away in February, 1967. The National Free Flight Society honored his contributions by producing a perpetual trophy to be given to the high time flier in Coupe D'Hiver at the annual AMA Nationals. Dick was subsequently honored again by inclusion in the Free Flight Hall of Fame in 1979.

Now, via several sources, comes the word that National Free Flight Society co-founder, Carl Fries, has also passed away. On December 6, 1989, Carl succumbed at age 75. In late November, I received a nice manila envelope from Carl wherein he noted that he had been nominated to the AMA Hall of Fame by his cross-country buddy, Vic Cunnyngham. Carl was one of those fellows who believed strongly in the free flight sport, and he was tireless in his support for the National Free Flight Society. In 1979, he was also honored to membership of the NFFS Hall of Fame. As a part of his induction, Hardy Brodersen noted the following:

" 'Uncle Carl' to most NFFS people is, with Dick Black, the founder of the NFFS. He earned his 'Uncle' appellation through his prodigious efforts in organizing this Society. He defined the tasks, found the people, cracked the whip to make it go, and caused a storm of Xeroxing to keep everyone informed, which probably raised Monsanto's office overhead by five hundred dollars a month. He chaired the first in-person meeting at the '65 Nats, in which most of the elements of our Charter and bylaws were identified . . . Carl started building in 1927 with the Chicago Parks District, held a twin pusher record in 1931, was Contest Board member in 1966-68, Safety Observer at the Nats in 1967, and is a Past President of the Kirkwood Thermaleers; A modeler's modeler."

So, Carl has joined with Dick Black once again. It may be that even now, the two of them are planning their next organizational effort. I know that without them, the National Free Flight Society would not be the organization that it is today. And now "Uncle Carl" has left us. I will miss his letters, his enthusiasm and drive. Most of all, I will miss him. I wish you the best of thermal flights, my friend.

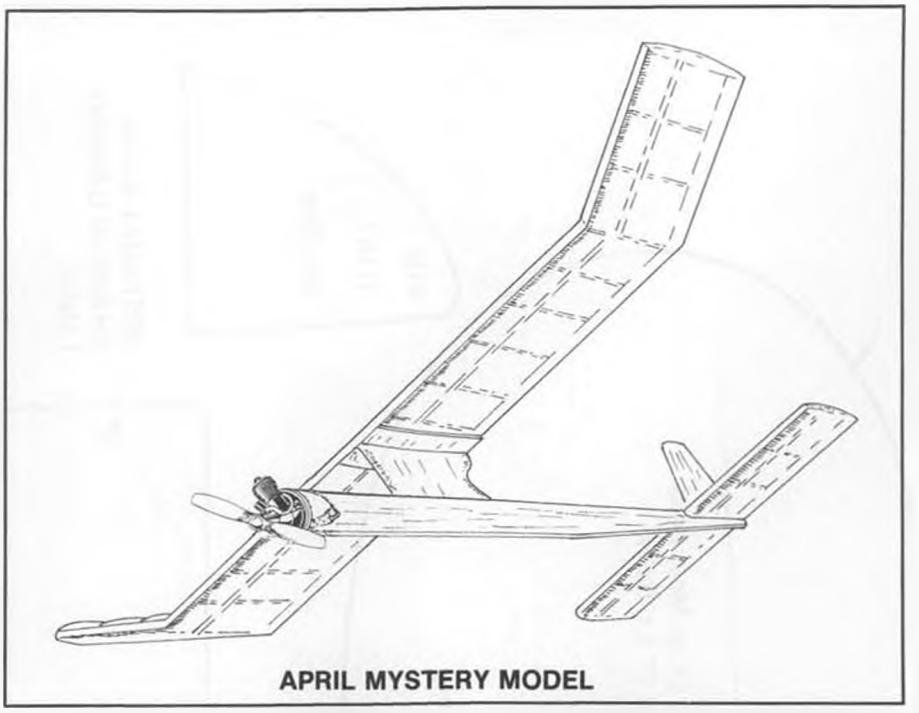
Del Adam launches his S.T. powered Mexi-Boy from the alfalfa at the Bakersfield Sky Kings meet. Old design by Al Vela glides like a champ. Schroeder pic.

APRIL THREE-VIEW—BUSH HOPPER, A BEGINNER'S HLG.

Last summer, Shirley Gode, local artist and club member, had an idea to spur the involvement of junior age fliers in our club contests. She decided to sponsor a contest for youngsters under 12 years of age to compete in hand launch glider. The catch was that the gliders were to be built by members of the Willamette Modelers Club. Any design would do, but these gliders, once built, were to be put into a

Chuck Wright with a Cultured Pearl 750 powered by a K&B 6.5. A movin' machine. Lee Schroeder photo.

John Villnave and Jim Lebda prep their K&B powered Shocer in the alfalfa at Bakersfield Sky Kings meet. Schroeder pic.



APRIL MYSTERY MODEL

The late Carl Fries (on right), co-founder of NFFS, with flying buddy Chris Matsuno. Photo taken in 1987 at Buder Park flying session in St. Louis. Carl died on December 6, 1989.

box and chosen by the fliers. No fee was charged, and the awards included certificates and prizes for all contestants. With minimal publicity, fifteen youngsters came to the meet . . . held in conjunction with one of the club contests . . . and flew. The majority of gliders were Bush Hoppers. Al Grell built seven of them himself.

The Bush Hopper was originally designed when my own children were just getting started in free flight (close to twenty years ago) and wanted to learn to fly. The Bush Hopper was a shrunken version of the Hedge Hopper HLG design by Warren Kurth. The original was light and simple to build . . . and you could learn to fly easily with it. So, it seemed appropriate to build a smaller one that could be flown by youngsters who had not flown before.

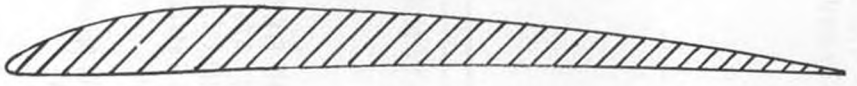
The model is very straightforward to build, and the plans are self-explanatory. It should be built with left glide turn via left stab tilt and a bit of left rudder tab. Balance as shown, and your local young beginners should have a blast with it. The wing is just a bit on the thin side with only 1/8-inch sheet, and if you can find some lightweight 5/32, it would be even better wing stock. Build it ruggedly, as some of the kids have strong, though uncontrolled arms.

You should have a really good time building these ships, and the kids will have a great time flying them.

APRIL MYSTERY MODEL

Keeping with the beginner's model theme, this month's mystery model was designed with the beginner in gas free flight in mind. The ship has a number of features that make it easy to build and fly. Specifically, the airfoils are semi-symmetrical, the dihedral is on the tips only, and all of the components are straightforward and simple. The designer was very prolific during the 1950s, and is still active these days. If you need a clue to identify the designer, take a close look at the fin shape. Now, if you think you know the name of

DARNED GOOD AIRFOIL—ISA 571



STATION	0	1.25	2.5	5.0	7.5	10	15	20	30	40	50	60	70	80	90	95	100
UPPER	1.00	2.67	3.55	4.87	5.70	6.40	7.25	7.80	8.03	7.72	7.17	6.32	5.32	4.10	2.50	1.50	0.30
LOWER	1.00	0.24	0.00	0.00	0.00	0.20	0.40	0.55	0.65	0.70	0.70	0.62	0.55	0.44	0.35	0.15	0.00

DIHEDRAL
1-5/8" Under each tip
3-3/4" Total

FLIGHT PATTERN:
Right Climb - Left Glide.
Use Left Stab Tilt and
Slight Left Tab

FACE LEADING EDGE AND TIP WITH BASSWOOD OR SPRUCE

HIGH POINT

RIGHT WING PANEL - 1/8" x 3" Lt. or Med. Balsa
FULL SIZE or 5/32" x 3" Lt. Balsa

FINGER GRIP: 1/8" Balsa - Right Side Only

FIN
1/16"
Full Size

FULL SIZE WING AIRFOIL

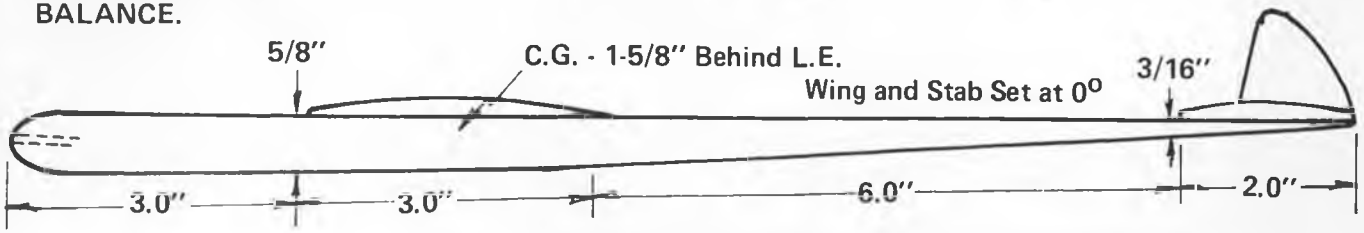
USE ALIPHATIC RESIN ADHESIVE THROUGHOUT. APPLY ONE COAT OF FILLER AND ONE COAT OF LITE-COTE OR THIN NITRATE.

STAB -1/16" x 2" x 5"
or 1/20" x 2" x 5" Lt. Balsa
Round Edges

FULL SIZE

OPTIONAL STAB SHAPE IN DASHED LINES

USE FINISHING NAIL AND CLAY TO BALANCE.



Fuselage is 5/8" x 1/8" x 14" Blank - Stringy Med. Stock - Drawn Half-Size

BUSH - HOPPER
A Beginner's H.L.G.
By BOB STALICK
with Apologies to
WARREN KURTH
Redrawn from
Original Aug. 1989

the ship, drop a note including this information, along with your name and address, to Bill Northrop, c/o *Model Builder* magazine. If you are the first in line with the correct answer, you can get a free, one-year's subscription to *Model Builder* . . . a good deal, if I do say so myself, and I do!

MYSTERY MODEL SOLUTIONS

Ross Thompson, of Vancouver, Washington, correctly named the August '89 M/M as the "San Diegan," designed by Denny Davis. Ross also brings up a question concerning the SD's eligibility for the Nostalgia category, pointing out that the plans show an ignition Torp 24 and the publication date is listed as January 1947, yet the model is not on the eligibility list.

Although designed by Howard Timlin and George Aldrich (I don't see any lead-outs on the drawing, George!), September's M/M, the "Univers-all," was inspired by the late Carl Fries, co-founder of the NFFS. Charles Bruce, Milano, TX, and Keith Hoover, Lombard, IL, and Ed Turner, Ft. Worth, TX, managed a three-way tie on this one! Belated happy birthday, Keith.

As you can probably figure out, we have just now opened all the M/M letters to determine the winners up through Feb. '90. Do you know who came in second on the Univers-all M/M? None other than the gentleman just mentioned as having inspired its design, the late Carl Fries. His answer was mailed to us in early August, about four months before he passed away.

Prof. Mark Levinson, Edmonds, WA, was first of many to identify the "Powavan," kitted by Frog, as the October '89 M/M. Full size plans are available from *Airborne*, an Australian model magazine, Ropomod Productions, Pty Ltd, P.O. Box 30, Tullamarine, Victoria 3043, Australia. Tell 'em we sent ya, Mite!

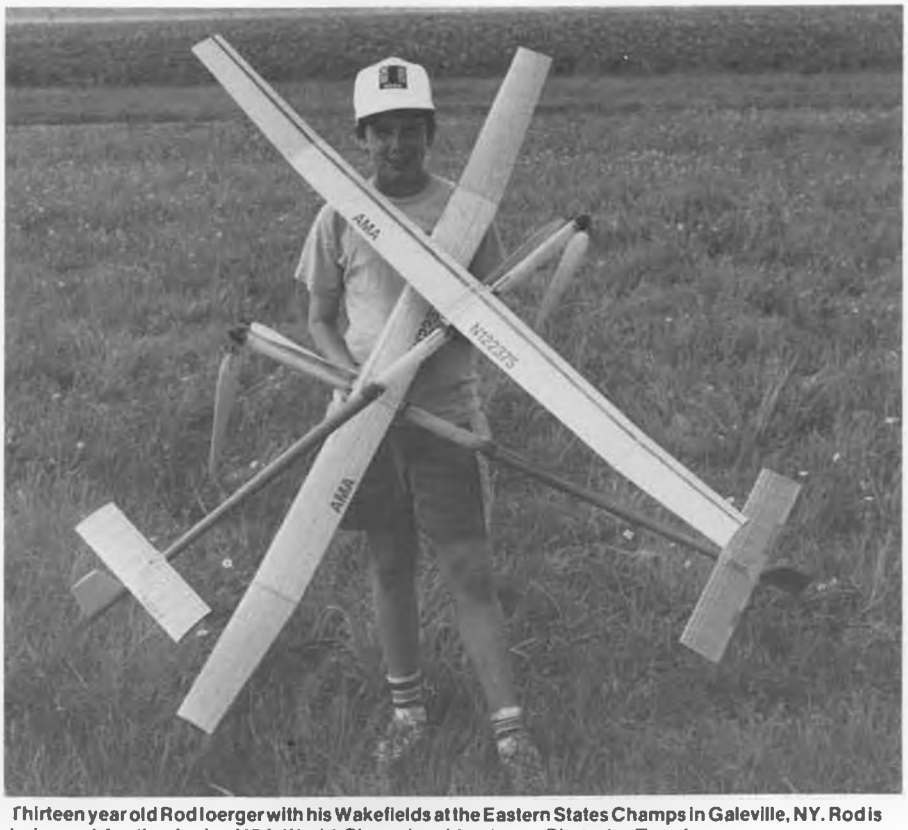
November's M/M brought us another tie. Don Assel, Canton, OH, and Bill Haught, Cincinnati, OH (The Ohio Post Office must have been working overtime!), correctly named it the "Sweet 16th" as designed by Aubrey Kockman.

There was no M/M in the December issue, as Bob's column was totally dedicated to describing free flight at the 1989 AMA Nationals. But that didn't let us off easy, as still another tie occurred on the January '90 M/M! Tom Cope, Issaquah, Washington, and Richard Diaz, Redlands, CA, did it to us on Bill Winter's "All American," as discussed herein.

Picking a M/M from February 1955 *Aeromodeller* didn't get by E.L. Haley, of Littleton, CO, who correctly named the "Bim-Bam," a rubber powered R.O.W. (or R.O.G.) model designed by R.J. Coles.

That does it for winners in the USA, but as we mentioned some months ago, we've opened up a special category for our many overseas readers, who obviously can't fairly compete with stateside modelers. The following are readers who have been the first from their country to send in correct answers. First, we have a winner from Buenos Aires, Argentina, whose name and address is so badly scribbled that we can only figure out the city and country. If you read this (first name looks like "Arcangel"), please PRINT your name and address so we can send you a free subscription. We were able to do a *little* better with Neil Molloy, of Adamstown, N.S.W., Australia for naming the "Powavan," which was also correctly named by Ian Anderson, Surrey, England. Come on, guys, PRINT your names and addresses. Your writing is like doctors' prescriptions, which only the pharmacists can read (I hope!). And finally, Derek Bird, also from Surrey, whose handwriting is at least easier to read, was the first reader from England to identify the "Sweet 16th" from November '89.

Continued on page 92



Thirteen year old Rod Ioerger with his Wakefields at the Eastern States Champs in Galeville, NY. Rod is trying out for the Junior USA World Championships team. Photo by Tom Ioerger.

Control Line

BY JOHN THOMPSON

Look closely at the more radical rear line rake common to combat planes (see text). Bill Varner prepping the authors "Underdog" at '89 "Bladder Grabber."

A goal of every control-line flier is to have a plane that performs the desired tasks while staying tight on the end of the lines and always in control of the pilot. Whether the tasks involve combat maneuvers, aerobatics, carrier fast and slow flight, racing takeoffs and landings, or scale touch-and-go, line tension is critical.

Sometimes, alas, it is also elusive.

All sorts of methods have been used to assure line tension: Engine offset, rudder offset, wingtip weight, line rake. It used to be that every airplane kit or design showed significant rudder offset; nowadays, many airplanes have little or none. Has aerodynamics changed? What is it that keeps our planes tight, or makes them loose?

That's the gist of a letter from Thomas E. Stephens of St. Clair Shores, Michigan, who asks some excellent questions. Here's his letter, followed by some discussion of the issues he raises.

"I have been a control-line model airplane enthusiast for approximately 35 years. I have built CL planes from the early Sterling Ringmasters and Yak 9s of the mid '50s to some of the latest foam wing combat planes of today.

"Well, have a question for you whose answers may be of significant interest to thousands of control-line fliers of today. It is simply as follows:

"What is the very best design technique for maximizing a control-line airplanes amount of line pull? Is it one or a combination of the following design parameters:

Joe Wagner's "Chicadee." Cox .15 Medallion powered, it's silk covered and equipped with big wheels for F.O.G. (flying off grass). "Buried" fuel tank is homemade uniflow, pilot is "Narrow-minded Nell." Weighs 18 oz., wing area 220 sq. in. Model is 12 years old and flies great.

"1. Engine offset? If so, how many degrees?

"2. Rudder offset? If so, how many degrees?

"3. Wing leadout line rake? If so, how many degrees or inches as measured at the leadout wingtip? Should front and rear line have the same rake angle? Also, what should the optimum distance be between the front and rear leadout wires as measured at the leadout wingtip?

"My incentive for asking these questions came as a result of my attendance at a 'season finale' contest held at the Ford Test Track, Utica, Michigan, on October 9 and 10, 1989.

"While watching one of the beautiful stunt planes being flown through the required stunt maneuvers, during strong winds, I overheard one of the contest directors (who himself flies stunt and combat planes at the contest) tell another official the following:

"The real secret to getting the maximum amount of line pull from a plane is the amount of leadout wire line rake, and the amount of 'engine offset' and 'rudder offset' doesn't have a thing to do with it!

"Well, thinking about what the contest director said, I began to observe some old Sterling Ringmasters being flown (which as you know they have zero leadout wire rake angle). I noticed that they seemed to wobble when coming out of outside loops, etc., and when flown upstream that day (in heavy winds) they seemed to lose what little if any line pull they might have had, thus causing a lot of uncomfortable situations for their pilots.

"This made me think back over the years when I and my friends lost several aircraft due to loss of line pull while doing wingovers, etc. I only wish I had some of those fine planes which were unfortunately destroyed and scrapped. A few of those fine planes were as follows:

"1. All American Sr. (by Demco).

"2. Cougar (by Midwest).

"3. Ruffy (by Sterling).

"4. Circus King (by P.D.Q.).

"None of these planes had line rake. They used only engine and rudder offset to achieve line pull.

"I thought . . . could the old masters Jimmy Walker, Bob Palmer, Riley Wooten and Carl Goldberg have been wrong? They only suggested engine and rudder offset and rudder offset as the means to get good line pull. Could they have overlooked something so obvious yet apparently so simple and effective as line rake?

"I notice that the newer planes of today (such as the VooDoo (Carl Goldberg), the Lil Satan (Goldberg), the Checkmate (*M.A.N* design article), and the Hornet (box Generix Kits), all now utilize line rake.

"I would appreciate your answer to my question and perhaps it could be included in one of your magazine articles as it is a basic subject that I believe would be of great interest to all control-line fliers!"

I agree, Thomas, that line tension is a subject worthy of some discussion.

In short, my answer to your questions would be that, yes, line rake probably is the most important factor in line tension.

However, there are several qualifying statements that need to be added.

Line tension is a product of several factors which are different for different types of airplanes. As the types of airplanes differ, so do the amounts of line rake, tip weight, engine or rudder offset change. So, nobody could make an absolute statement about the amount of any of these adjustments that would apply to all planes. It's more helpful to develop an understanding of how these factors affect flight and how to search out the right combination for your particular airplane.

If I were pressed to give an order of importance to the factors affecting line tension, I would list them something like this, with No. 1 being most important:

1. Line rake.
2. Horsepower.
3. Outboard tip weight.
4. Engine offset.
5. Rudder offset.

It's important to note, also, that the best term to use in discussing line tension is not "maximum" but "optimum." It is possible to have too much line tension—and in that case the extra pull is sapping strength away from your engine, making it pull against the pilot rather than pulling the plane through the air.

One thing to remember—which some of the early designers either didn't consider or were hesitant to trust—is that the plane, as it turns in a circle, always is naturally trying to pull away from the pilot. There's not much need to build in rudder control or engine offset to create a right turn when in fact the plane is seeking to go straight against lines pulling it to the left. This would seem to explain the relatively greater effectiveness of leadout position as a means of adjusting tension as opposed to rudder or engine offset.

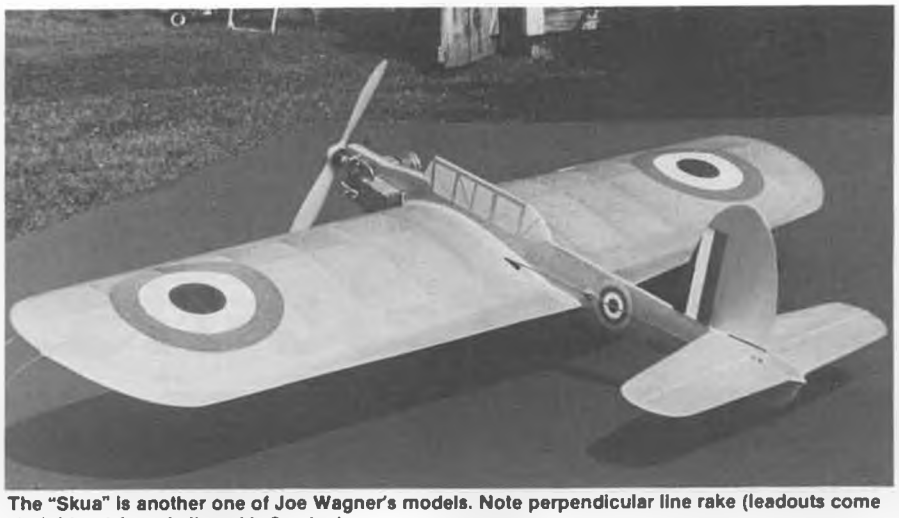
Let's discuss each of the factors listed above in turn:

Line rake:

Actually, it probably could be said that all planes have line rake. In some planes, like the traditional Ringmaster, the lines are perpendicular to the fuselage. In others, such as the typical modern fast combat plane, they are raked backwards, so that they exit near the rear of the wingtip. Still other planes, such as racing and speed planes, many actually have a tiny bit of forward rake.

What you are doing with the plane is a key to the amount of line tension you want. Many factors are involved, and they can vary even with different copies of the same plane. This is why many modern designs have adjustable leadout guides, so that the rake can be adjusted as final trim is sought.

You are seeking the amount of rake that will keep the plane tight on the lines, while not being so great as to cause poor maneuvering or unnecessary pull. For the fast combat plane, used in extremely violent and rapid-succession maneuvers, more rake is used to keep the plane tight through all those wild gyrations. For the racing plane, much less rake is needed because there is virtually no maneuvering. The precision aerobatics plane falls somewhere in the middle—and with the stunt plane the trimming is so precise that the adjustable guide is almost mandatory. Navy carrier planes, which need to perform both high and low speeds, must either reach a compromise between the two requirements, or use a "line slider" that shifts lines from nearly perpendicular to the fuselage during high speed to extreme backward rake during slow flight.



The "Skua" is another one of Joe Wagner's models. Note perpendicular line rake (leadouts come straight out from bellcrank). See text.

An example from real life; Top Northwest Super Sport Race competitor Dave Green, of Astoria, Oregon, equips all his Minotaur NWSS planes with adjustable leadout guides. He sets the guide at a midrange for maiden flights and gradually reduces the backward rake until the plane becomes light on the lines; then he adjusts it a tiny bit back for optimum tension. If for some reason the leadouts can't be raked far enough forward to find that optimum point, Dave is not above using engine inset to find that point of optimum trim for speed around the circle.

Responding to a couple of your questions specifically: I doubt that it's the rake that causes the Ringmaster to wobble in maneuvers. In fact, my experience with a dozen or so Ringmasters is that the rake is about right for general flying as well as for racing. All Ringmasters built according to plan tend to wobble on brisk aerobatic maneuvering, more likely as a result of the particular airfoil and control moments than as a result of line tension problems. The same can be said for the VooDoo, which actually by now is about a 30-year-old design; that's a plane that flies quite well with a Fox .35 stunt but becomes a very crabby, wobbly plane with more horsepower such as provided by a modern combat engine.

In regard to leadout separation, this may surprise you. For most airplanes, no separation at all is necessary; and the amount of separation probably is immaterial within reasonable limits. Many racing and two-wire speed planes have the leadouts exiting the wing in the same hole. I have built external-control combat planes with a single leadout guide that flew quite well. Now it's how far apart the lines are that matters, it's the angle at which they leave the plane. It also may surprise you to know that some fliers consider the placement of the bellcrank within the wing to be relatively unimportant—as long as the leadouts exit the tip in the right place, they evidently can go more or less anywhere inside the plane. However, it does make a difference which way the bellcrank is turned in the plane. It is better—albeit only slightly so—

Continued on page 88

Miles Magister built and flown by Piotr Zawada of Poland, powered by Supertigre S.61 K. Placed second at '89 Polish Nats. Zawada photo via Stu Richmond.

Free Flight Scale

By FERNANDO RAMOS

Bill Hannan, now living in Northern California, surrounded by admirers. All photos taken at Flightmasters Flying Aces-style contest last August at Mile Square Park, Fountain Valley, CA.

Free flight scale veteran Clarence Mather, has retired and lives in Bishop, California.

Yes, Virginia I am alive and well! It has been a bit of a respite, but I am back in the saddle again! A lot has happened since I last wrote this column, and it will take some time to get everything in order again.

I want to start this month recounting my experience at last year's AMA Nats. Most everything I have read about the Nats has been from a different perspective than mine will be . . . that of a contestant.

On a Sunday in July of last year, Mac McJunkin and I flew my '49 Bellanca Cruisair to the Nats, held in the state of Washington. We flew along the base of the Sierras, enjoying the majesty of these incredibly beautiful mountains. We landed at Klamath Falls, Oregon where we spent the night relishing the cool, brisk air, and the warm hospitality of the people.

We didn't have to be in Washington until Wednesday, the day that F/F Scale models were to be submitted for judging. As we had plenty of time, our departure from Klamath was leisurely to say the least, partaking of breakfast, and checking on weather. As it turned out, we couldn't have dialed in any better weather for our flight northward!

Our specific destination in Washington was Richland, the site of Nats Headquarters. In less than three hours flying time, we landed at the Richland airport. The first thing I did was to top off all the tanks with fuel. The line boy pumping the gas wanted to know where we were from and what we were doing in Richland. I told him that we were here to fly model airplanes. His reply was, "Why would anyone want to come here and do that?" Little did I know how prophetic he was!!

The rest of that day was spent getting our car rental, checking into our motel, then making a quick trip out to the F/F site

Nice Bearcat built from Dave Diels' kit, by Bob Curry.

Jack Smith and his electric powered Fokker Tri-Motor "Southern Cross."

Mac McJunkin holding his unusual tandem wing Triavion Albessard. We knew that!

Officials Johnny Rapillo (left) and Darcy Staggs get ready to time Dick Howard's Barracuda.

Bob Haight with his fine flying Italian Reglane.

to see where the flying was supposed to be. Wednesday finally rolled around, and I submitted my Sopwith Triplane for judging in the power event. There were only seven entries in power, and nine in rubber scale. This was the Nats? Standing around observing some of the nice models entered, I mentally judged what I thought would be first and second in rubber scale. I later found out that these two came out ninth and eighth respectively! The same thing happened in power scale.

While in the judging room, we were given the word that on the following morning we were to meet at the Convention Center at 8 a.m. sharp. So, after an early breakfast, Mac and I headed for the Convention Center. When we got out of the car, it was all we could do to stand up straight, the way the wind was blowing.

The contest director pointed down the road about a half-mile, to what was going to be our flying site. This was complete with curbs and light standards. From here the models were to ROG! As if this wasn't enough, both sides of the road were filled with large rocks and chaparral!

Actually, there was little dissension, as no one really believed that there would be any flying at all, with 20 knot winds blowing. After realizing that the initial site wasn't too great, arrangements were made to fly at the R/C pattern site . . . that is if we stayed on our side or end of the field, ha!

As it turned out, no one actually flew, and around 4 p.m. they handed out trophies based solely on static scores. Have you ever heard of that? Not one official

Bob Weatherall and his impressive CO_2 powered DeHavilland Dragon. Really pretty model.

came up with the idea to postpone the flying until the next day. The inflexibility of the AMA prevents this type of logic.

Mac and I got up real early Friday morning and departed for home at 6:30 a.m., enjoying the return flight. We arrived at the Chino airport about 4 p.m., tired and with mixed emotions. Suffice it to say, that I will never attend another AMA Nationals, and thank goodness for the Flying Aces Nationals!

Did I say Flying Aces? In August of last year, the Flightmasters held their first-ever Flying Aces style contest. This two-day affair started with the judging in the back yard of my home. While the judges were busy looking over the great models, the rest of us visited and had a delicious catered meal. Others enjoyed the full-size biplane project in my barn, along with all of the modeling stuff I've collected over the years.

We had about 45 contestants and over 60 models entered. This wasn't too bad, considering that this was the first contest of this kind out on the West Coast.

Flying took place on Sunday, and the weather was perfect. The skies were dotted with all kinds of models for many hours. The spectators were truly enjoying all of the activity going on!

After the flying, the lucky winners received beautiful trophies for their efforts. The next contest of this type that the Flightmasters will sponsor, will be in August of 1991. This alternates with the FAC Nats. I hope to see many more of you the next time around!

Finally, in closing, I have many new items to share with you, but these will have to wait until next time. •

Workbench . *Continued from page 7*

the heaviest, and who balances and aerodynamically trims his or her aircraft before being satisfied with the model's performance.

Of course, free flighters will say that their aerodynamic trimming has to be more precise than for a control line or radio control model, as they have no further control of stability once the model is released in flight. True to a point . . . that point being beyond which there is not enough control available to save a badly trimmed C/L or R/C model. On the other hand, a properly trimmed C/L or R/C model needs no control compensation once it's in the air, making it much easier to fly properly.

As a rule, we find that free flight modelers, especially those who have had no experience in R/C, are overly critical of R/C modelers in general. To a certain degree, this is understandable, as many R/Cers have had no practical free flight experience. To them, CG means Carl Goldberg Models, and balance point is how much money you have left in your checking account after buying that latest radio system! However, F/Fers should get down off their pedestal and check out the activity at a busy R/C club field. Sure, you'll see some beginners floundering around with badly trimmed models adding to their early flight problems (You don't have any of these at a F/F contest?). You'll see others boring aimless holes in the sky without rhyme or reason for their actions. However, with careful observation, it won't take long to discover the true modelers in the club. Their aircraft are neatly built and finished, often times original designs. Their pit area is uncluttered, with just the essential equipment around their model. When it's their turn to fly, they position the model so the prop blast aims out toward the field, not into the pit area. The engine starts on the first or second flip, and idles low enough to just tick over without faltering. In the air, the

model flies smoothly and performs maneuvers with precision and purpose. The free flighter may even be surprised to find out that between flights, these modelers will talk with them about their models and, that they speak the same language. They understand balance, thrust angles, fuel mixtures . . . all that good stuff. They're modelers, but just happen to have a different way of expressing their interest. And by the way . . . don't be too surprised if you happen to pick up some new building tips during the conversation! •

Jake..... *Continued from page 7*

ARF - What Little Orphan Annie's dog says when asked about ready-to-fly model airplanes.
Divine Wind - Weather pattern after baked bean night on Mount Olympus.

Golf

Bunker - Edith's husband.
Sand Wedge - A club, with chips and a pickle.
Two Wood - How many Yugos out of a hundred would survive a 5 mph collision.
Tee Shot - Drink made with Lipton and vodka.
Bad Slice - Moldy piece of bread.
Double Bogey - Twin bill featuring Casablanca and The African Queen.
Pitching Wedge - Lift in Orel Hershiser's shoe.
Caddy - What you drive to the country club.
Downhill Lie - Event at the Prevaricators Winter Olympics.

Bowling

Beer Frame - A veteran league bowler's physique.
Brooklyn Hit - Mob contract killing in New York.
Five Step Approach - New book on how to pick up women.
Four Step Approach - Reader's Digest condensed version of new book on how to pick up women.
Baby Split - Stephen King dessert.
Perfect Game - Strip poker with Loni Anderson and Adrienne Barbeau.

Gardening

Pruning - Constipation treatment.
Weeding - Smoking whatever you pull out of the garden.
Vegetable Dust - Found on the leaves of tomatoes with dandruff.
Cinch Bug - The one to bet on in the beetle races.
Sprinkler System - Elaborate device for putting those little chocolate things on ice cream cones.
Fertilizer - Geraldo Rivera.

Boating

Transom - Money paid to get back a kidnapped boat.
America's Cup - Ted Turner's athletic supporter.
Heave To - Throw up twice.
Poop Deck - Where sea captains kept their messenger pigeons.
Flying Bridge - Often seen when boxer "Gums" Denardo was punched in the mouth.
Head of Steam - Ship's bathroom on a very cold morning.

Fishing

Crappie - What the weather usually is on the day you planned to go fishing.
Plastic Worm - Insect that infests domestic car dashboards.
Fish Finder - Match maker service for those interested in holy "mackerel"-mony.
Salt Water Tackle - Lineman for the Miami Dolphins.
Dolly Varden Trout - A fish that could never sink.
Fiberglass Pole - Statue in Warsaw.

Electronics *Continued from page 14*

channel equipment and not the 7UAP, since as I stated, the former also has this blocking diode installed. Well, I must assume that instead of the current 5UAP

transmitter, he is using the older 5NLP PCM transmitters which did not have such diodes.

As the old saying goes, the difficult we do immediately, the impossible takes a little longer, so let's go right to Terry's challenge, which we will not only accept, but solve. With a choice of three possibilities yet!

First of all though, I think that Terry is being unjustly critical of himself as being too "dumb" to arrive at this solution by himself. Unfortunately, the photo of his CL 215 that he enclosed is too blurred to share with you, but it is definitely in the air over a large body of water. It is a traditional hulled seaplane, somewhat reminiscent of the old Martin PBM, and though he did not include details as to size, scale, etc., there is no doubt that this was an ambitious undertaking and in my book, not the work of anyone lacking the old gray matter.

Anyway, Solution One. Definitely the easiest, though it will involve the swallowing of one's pride: Put a water rudder on it . . . but make it out of clear Lexan or Plexiglas. I can guarantee that by the time the airplane is far away enough to have obtained takeoff speed, the colorless rudder will have become invisible and will remain so until you taxi back up in front.

Obviously though, friend Terry is something of a purist, and might prefer Solution Two, which does not involve a water rudder and makes use of some of the features of his 7UAP, but which could also be done with a number of less sophisticated transmitters. Basically, we are going to use Channel 7, which is a knob-actuated proportional channel, to control the inputs to the two throttle servos. With the Channel 7 control knob in neutral, both servos, Y-harness-connected into Channel 3, the throttle channel, operate normally. When the Channel 7 knob is rotated towards the left, signaling a left turn, the left engine throttle, previously set at idle, becomes inoperative and only the right engine will throttle up, making the airplane swing left. The reverse is true when the Channel 7 knob is rotated towards the right.

Just how do we accomplish such wondrous things? Read on! It is a lot simpler to do than the telling might make it sound. We will be using a servo operated by Channel 7 to actuate micro switches, which in their normally closed position (servo at neutral) feed the control signal to both servos, as is normally done. In either left or right direction of the servo output, it will operate a micro switch cutting off the control signal to the appropriate servo and rendering it inoperative. The only real consideration here is the actuation and wiring of the micro switches. The wiring is simple, and involves only the cutting of the white signal wire in the throttle servo extensions. See the diagram for this information.

Now, for the purely mechanical function of operating the switches . . . we even have more than one method of so doing. On second thought, maybe Terry isn't going to like all this. Decisions, decisions, decisions!

The first and, to me, simplest method to operate a micro switch with a servo is to use a clever little device from Ace R/C, called, of all things, a "Switch Box"; Ace No. 60K31, at $4.95. It is all there, the micro switch, mount, and actuator. It is mounted remotely from the servo, an inch or two will do, and is operated with a length of music wire in the same manner as any other control rod. The actuator rides on the wire and is secured with a set screw to adjust the switching point as necessary. I like this device, and strongly recommend it for this and any other servo actuated switching application. In this case, of course, we will need two such units, one for each engine. Space permitting, both units could be mounted in line and operated by the same piece of wire, but they could also be mounted separately and operated by separate wires, one from each

side of the servo output arm. The switches provided are SPDT (Single Pole Double Throw), making wiring easy; you hook things up to go on or off as required without the need to consider the mechanical properties of the switch.

Alternately, the switches can be mounted on a piece of plywood and operated by a servo mounted cam. This is a simple mechanical action which can be accomplished in many ways. One possibility involves the use of a large servo output wheel, Futaba No. FSH-6R, and two roller lever operated switches, Radio Shack No. 275-017. The servo should first be mounted on a piece of lite ply, with the output end protruding up through an appropriately sized hole. The output wheel, modified as shown in the drawing, is then attached, and the switches mounted so that when the wheel rotates to the proper place, the roller falls into the depression allowing the switch to operate. Mount the switches so that they will operate at about 30 degrees each side of neutral, and then adjust the servo throw through the transmitter so that switching takes place at 90 degrees rotation of the Channel 7 knob.

I am not including any exact dimensions or locations, as anyone capable of completing a project of the magnitude of the CL 215 does not need them. Also, the basic idea can be used for many other switching applications and with any R/C system and transmitter. My only suggestion, a strong one, is to avoid temptation to hold things together with double sided tape. Take the time to screw things down properly, the extra safety will be worth it. Think about it . . . if this gizmo fails mechanically while in the air, it could result in one engine stuck with an open throttle, which could make things unpleasant both for the pilot and for the ecology of the lake.

Though I would prefer to accomplish this unique task in a purely electronic way, this might be the preferred way, as all throttle functions remain completely normal, including the trim, which affects both engines in the normal manner. Solution Three, to follow, using the mixing functions within the transmitter, gives the same differential throttle results, but loses this important throttle trim function on one engine, and requires even more mechanical tinkering than does this method. Let's fly that one past Terry for this judging; even with some inherent disadvantages it should still be worthy of at least 7 or 8 points.

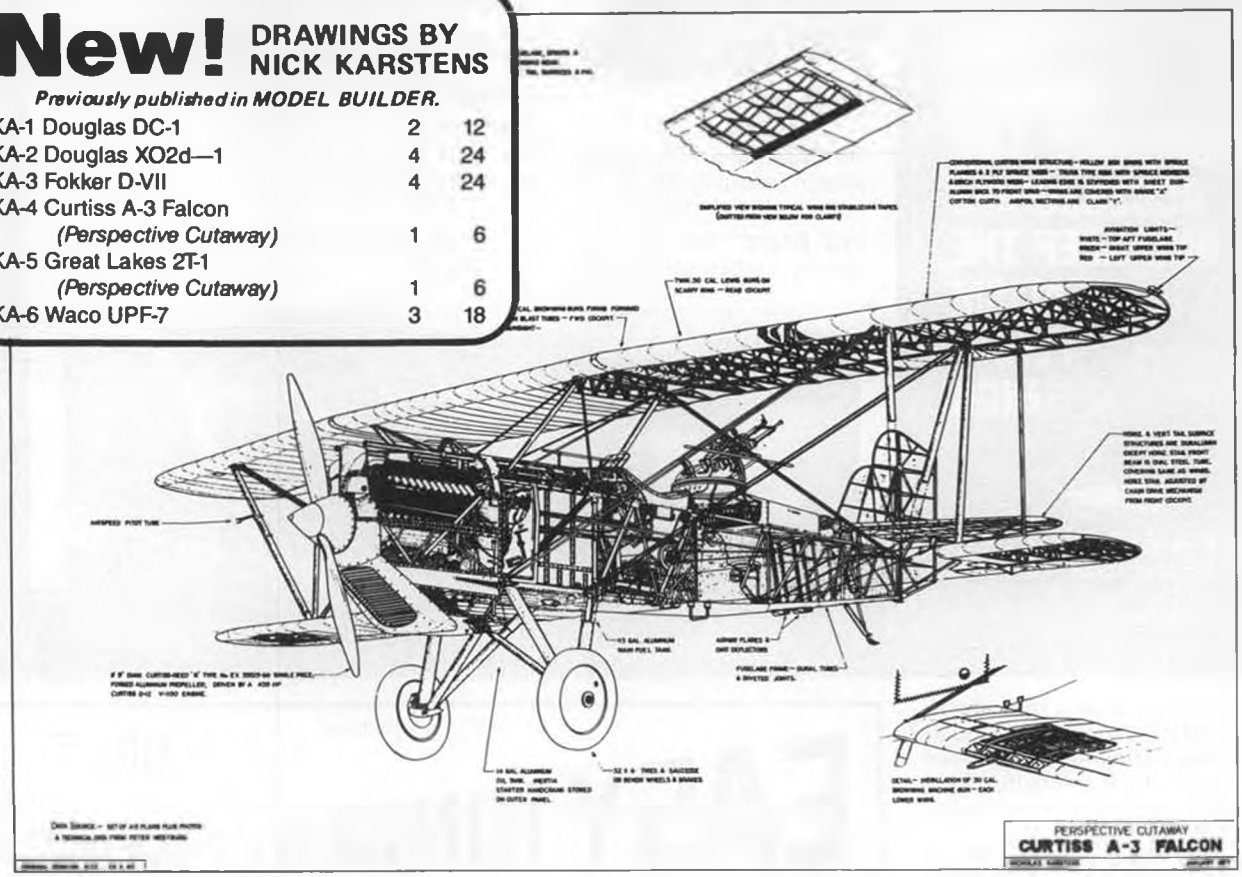
Solution Three makes use of the programming features of the 7UAP for which Terry bought the system in the first place. Probably the reason he has not figured this out for himself is the somewhat inadequate instruction manual, which dwells a lot on what the equipment can do, but little on how to make it do it. The function to be used is PMX 1, Programmable Mixing 1, as explained on page 11 of the manual. We are going to mix Channel 3, the normal throttle channel, and Channel 7, the same proportional knob operated channel used in the previous method. Channel 3 is to operate the left engine throttle servo; channel 7 the right engine. Before we get

Peter Westburg's
SCALE VIEWS

New! DRAWINGS BY NICK KARSTENS

Previously published in MODEL BUILDER.

KA-1 Douglas DC-1	2	12
KA-2 Douglas XO2d—1	4	24
KA-3 Fokker D-VII	4	24
KA-4 Curtiss A-3 Falcon *(Perspective Cutaway)*	1	6
KA-5 Great Lakes 2T-1 *(Perspective Cutaway)*	1	6
KA-6 Waco UPF-7	3	18



SUPER-ACCURATE AIRCRAFT DRAWINGS. USE FOR SCALE DOCUMENTATION AND/OR FOR DEVELOPING MODEL CONSTRUCTION PLANS. ALL DRAWINGS ARE 28 x 40 INCHES BORDER- TO-BORDER, AND ARE SCALED AS LISTED BELOW.

	No. of Shts.	$
1/24 scale: ½" = 1 ft.		
WE-18 Douglas O-35/B-71	1	6
WE-23 Douglas XO-36/XB-7	1	6
1/12th scale: 1" = 1 ft.		
WE-2 Boeing F4B-4/-3	4	24
WE-3 Boeing P-12E	3	18
WE-4 Curtiss A-8 Shrike	3	18
WE-7 Curtiss Gulfhawk 1A	2	12
WE-8 Curtiss N2C-2 Fledgling	4	24
WE-9 Curtiss O-1B/A-3 Falcon	3	18
WE-10 Curtiss P-1B Hawk	3	18
WE-12 Curtiss XP/YP-23	3	18
WE-13 Curtiss SBC-4 Helldiver	4	24
WE-14 Czech Avia B-534	2	12
WE-15 Davis D-1K	2	12
WE-16 Douglas O-25C	3	18
WE-17 Douglas O-31A/O-31B	3	18
WE-19 Douglas O-38/O-38B	2	12
WE-20 Douglas O-43A	3	18
WE-21 Douglas O-31C/Y10-43	3	18
WE-22 Douglas O-46A	3	18
WE-25 Fokker D-17	3	18
WE-26 General Western Meteor	1	6
WE-28 Grumman F2F-1	3	18
WE-29 Grumman F3F-2	3	18
WE-34 Stearman 4E Mailplane	2	12
WE-36 Travel Air 2000	2	12
WE-37 Waco ATO Taperwing	2	12
1/10 scale: 1.2" = 1 ft.	Shts.	$
WE-1 Berliner/Joyce P-16	4	24
WE-5 Curtiss BFC-2 Goshawk	4	24
WE-6 Curtiss F9C-2 Sparrowhawk	4	24
WE-11 Curtiss P-6E Hawk	4	24
WE-24 Fiat CR-32	3	18
WE-27 Great Lakes Trainer	4	24
WE-30 Hawker Fury Mk I	4	24
WE-31 Hawker High Speed Fury	3	18
WE-32 Hawker Persian Fury	3	18
WE-33 Monocoupe 90A	2	12
WE-35 Swedish Sparmann P-1	2	12

ORDERING INSTRUCTIONS (Minimum order: $10.00)

U.S. orders, including APO and FPO, add 20% of total order for shipping and handling. Overseas orders (includes Canada and Mexico) add 50% of total order. Remit payment by International Money Order or U.S. funds, drawn on a U.S. bank. Please, no cash or C.O.D.s. Master Card or VISA include card number, expiration date, and signature. Add 5% to credit card orders. Send payment to RCMB INC., 898 West 16th St., Newport Beach, CA 92663. Phone (714) 645-8830.

California residents add 6¼% sales tax.

to the programming, let's take care of the mechanical details first.

First negative: Use of the differential throttle in this method, the only way in which it can be done through this transmitter, will result in serious over travel of the Channel 7 servo when only one engine is being used, therefore an override device must be installed on the servo output. Fortunately there is no need to reinvent any wheels in this instant, Du-Bro No. 120, called its "Control Override Servo Saver" will fit the bill nicely. As you can see from the enclosed sketch, when installed and adjusted properly, this simple device permits normal servo and throttle operation. At any time the throttle reaches its mechanical limit, such as when excessive pushrod travel occurs, the springs compress, relieving the pressure back to the servo. The spring tension will have to be adjusted properly for best operation, and the servo must be prevented from stalling . . . but then, we never claimed that differential throttle was obtainable without some labor being involved.

Another consideration at this time is servo travel. If you have not yet installed all of your servos, or if you have extra ones, measure their respective travel and use the two that match closest. You may run in to some variations in the travel of the S-148s that come with the 7UAP; some time spent matching a couple now will make things easier later when you are adjusting throws for equal throttle reaction.

Control mixing in the transmitter is hard to understand; everything becomes much clearer when you can see mechanical movements. Therefore, I would recommend that you first tape a couple of servos to the end of a box, attaching pushrods to their output so that you can see the action. Pencil marks can be made to indicate the pushrod throws at both extremes, after which the effects of the mixing and adjustments can be readily seen.

Referring now to section PMX 1 of the manual, set the various steps for:

ACTIVATE
MASTER CHANNEL - 3
SLAVE CHANNEL - 7
MIXING DIRECTION +

With the P. MIX switch ON, and with the Channel 7 knob at neutral (Position 0), both servos will now operate as the throttle lever is moved. At this point, be sure that both are moving in the proper direction for high or low throttle as commanded. If any servo direction changes are necessary, make them at this time with the "REV" (Reverse) function.

The last step is to set the throw of the Channel 7 servo, per Step 5 in the instructions. The actual settings are determined by the settings of Channel 3 but the numbers are unimportant, as what obviously has to be done is adjust both of them for equal throw.

As in the previous method, the Channel 7 knob is now the key. Turning the knob to the right, to indicate a right turn, results in a higher throttle setting on the left engine, while turning the knob to the left gives the

opposite results. The exact difference in engine speed is determined by the engine's throttle response curve, and the amount of throw assigned to Channel 7, and lastly to the amount that the Channel 7 knob is turned. As I said earlier, it might sound confusing in the telling, but believe me, it'll work.

There is yet another inconvenience inherent in this method. The normal throttle trim controls only the Channel 3 servo, and has absolutely no effect on the one plugged in to Channel 7. Trim and cutoff if desired can be done with the Channel 7 knob, turning it towards the right. Its effect is extremely coarse . . . one click is the equivalent of the total normal throttle trim, but on the other hand it will work to kill the engine if desired. The whole installation will take a lot of mechanical and transmitter fine tuning, but once done, should work consistently and reliably. Have fun Terry! If you should scare up any interesting looking mermaids, send photos!

WEE R/Cers have some good news coming their way. I just heard From Bud Clauer, who was here with us in December, to tell us about Russ Pribanic and his CO_2 powered bipe using SMA (Shape Memory Alloy) actuators. (See September '89 EC). It turns out that Bud has convinced Russ to tell all . . . at least about SMA actuators . . . and we should be seeing it here in the pages of *MB* soon. I have nothing further at this time, just waiting like the rest of you.

Eloy Marez, 2626 W. Northwood, Santa Ana, California 92704. •

Big Birds . . *Continued from page 13*

may be wet, but it's mild). However, once he thaws out, this numbed Norseman comes up with great ideas.

His latest creative thinking spawned the Half Scale Racing Association (HSRA) which seems to have lots of appeal.

Although I happen to favor the IMAA non-competition philosophy, Crash's proposed HSRA guidelines have appeal and should get the HSRA off the ground. He points out that:

"The emphasis will be on Fellowship/Sharing with an overtone of low-key racing for enjoyment. Insignificant mementos may be given (never cash or merchandise) as the actual awards will be the 'braggin' rights' associated with winning."

Crash goes on to say that any half-scale (50%) Formula One type Midget Racer may be used (Cassutt, Shoe String, Pogo, Rivets, Bonzo, etc.), as long as it's a reasonable replica (wheelpants and spinners are optional) and can pass the IMAA airworthiness inspection.

The basic race course will be twelve laps around two flags located 440 feet apart and a race will consist of two aircraft released at a ten second interval. The Builder of the Model Rule will not apply in HSRA Racing.

All aircraft will be fitted with some kind of In-Air shutoff device (it can be an electric kill switch or a servo-operated choke). Also, aircraft may be painted any colors and carry the builders HSRA number. There are no plans for scale judging or static awards, and slight deviations in authentic scale will be allowed.

Crash hopes that the HSRA will become a common sight at future Fun-Flys and provide a form of competition for those who enjoy that kind of spice. He's planning to have the first HSRA get-together at the 1990 IMAA Festival at Oshkosh, Wisconsin (that'll be on June 28, 29, 30 and July 1, 1990).

If this concept grabs you and you want to join, or just find out more about the HSRA, drop Crash a line. There are no dues or meetings at the present time. H. "Crash" Evanson, 881 East Hyacinth, St. Paul, Minnesota 55106, (612) 776-8845.

This half-scale size should work out well and be a lot of fun. As Formula One type Midget Racers are small, our models should span between seven to nine feet . . . which is pretty much the same size we're used to. I've included some of the pix Crash sent along with his letter (I referred to "our models" because I'm HSRA #3; see you at the races).

ELECTRICS . . . OMT

Some months ago I included a list of reasons why I've been reluctant to jump into BIG "E"-Power. I did it with the intent to stir things up a bit but never dreamed that those few paragraphs would stir things up so much (even my editor, "Old" Bill Northrop, jumped on my tush).

This is not an apology for anything I wrote. I just wanted to let you all know that I appreciate any kind of response to what you read here . . . no matter what you write and no matter what you write it on. Less than a week after that particular issue

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came out I started to receive feedback and, as of the middle of January, letters about it are still coming in.

TRANSMITTER CARE

A reminder that your tranny also needs some TLC . . . so don't haphazardly toss it around. Let it ride to and from the flying field in safety and comfort, just like your battery pack and receiver do.

And every once in a while wipe off the case and telescoping antenna with a clean rag and some alcohol. If you let enough dirt accumulate in those antenna sections you could adversely affect your system's range.

THOUGHT OF THE MONTH

Middle age is the time of life when the problem isn't to resist temptation but to find it!

The new flying season is just about here so check all of your radios and support equipment. Cycle those batteries, test run those engines, and inspect those airframes carefully before committing any bird to the wild blue. And take it easy on those first few flights 'cause you're gonna be a little rusty after a winter's layoff. Be prudent . . . warm up slowly!

Al Alman, 1910 154th Street Court South, Spanaway, Washington 98387, (206) 535-1549. •

Counter . . . .*Continued from page 11*

"tab-lock" alignment, and a balsa/hardwood wing. Top front of fuselage, hatch, and cowl are pre-formed ABS plastic. Wheel pants are also included. Great model to have around for that fun flying weekend. And the price of $89.95 retail is great too. At your hobby shop, or contact Ace at 116 West 19 St., P.O. Box 511, Higginsville, MO 64037, phone (816) 584-7121/ Fax 7766, and tell 'em we sent ya!

* * *

Quarter-scale float-flying enthusiasts will be happy to know that Byron Originals has made an Edo 2000 Series Float kit for its Christen Husky, which means that you're all set for your quarter-scale Cub, Aeronca, Champion Citabria and Scout, or what have you. The floats are available in two sets. One is specifically for the Husky, with one brass retractable water rudder, spreader bars, complete strut assembly, and all necessary cable, pulleys, and fittings for the Husky. An additional water rudder is also available separately for those who prefer a dual rudder system. The other set, called the Universal Float System, includes the two injection molded, 48-inch long floats, 1/8-inch ply bulkheads, spreader bars, and twin fixed water rudders, plus all necessary assembly hardware. In either set, once the ply bulkheads are installed, and the two float halves are glued together, each float provides five completely separate airtight compartments for the maximum in float security. The company recommends that the floats be finished with epoxy resin and fiberglass cloth, also available as a package from Byron Originals.

The Husky float kit retails for $114.95, the Universal Float System lists at $49.95, the separate retractable water rudder costs $16.95, and the fiberglassing kit sells for $38.50. If your local hobby dealer doesn't have these items, you can order direct from Byron Originals, Inc., P.O. Box 279, Ida Grove, IA 51445, phone (712) 364-3165. Check with the company on shipping and handling charges before ordering.

* * *

The new Fox Quickee Sport 40 is now being shipped by Fox Manufacturing Co., 5305 Towson Ave., Fort Smith, AR 72901, phone (501) 646-1656/Fax 1757. This engine is more massive than the well-known Fox 40 Standard, and produces about 20% more power. It works well with 10, 11, and 12-inch propellers. It comes complete with muffler and spinner. It is available at your local dealer.

Appropriately enough, we finish this month's "Over the Counter" with . . . a finish. It is Pacer Technology's new Z-Poxy finishing resin, which replaces the recently discontinued Loctite brand Finishing Resin formerly handled by Pacer's three major outlets, Robart Mfg., 310 N. 5th St., St. Charles, IL.; House of Balsa, 20130 State Rd. Cerritos, CA.; and Frank Tiano Ent., 2460 SW 85th Terrace, Davie, FL.

Z-Poxy Finishing Resin is a relatively odorless, equal mix, fast-curing product that is an easy-sanding formula ideal for laminating, sheeting foam wings, and fiberglassing. It can also be used to make fiberglass parts or for fillet forming. Cure time is about 70 minutes, and the surface may be sanded in less than four hours. Next releases will be 5 and 30-minute formulas. •

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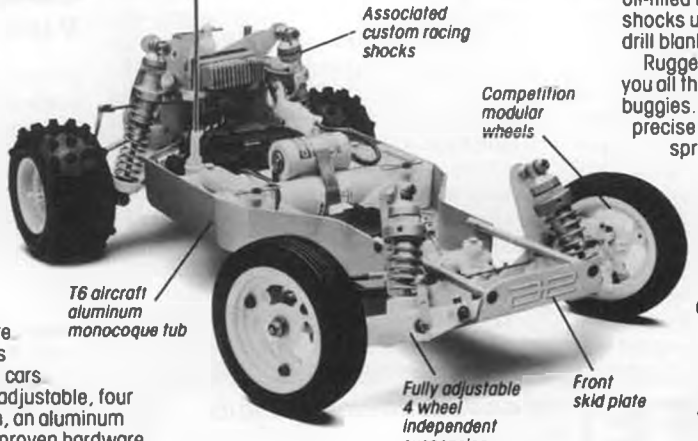
The new RC10 features fully adjustable, four wheel independent suspension, an aluminum alloy monocoque tub and race-proven hardware throughout.



oil-filled racing shocks. These custom shocks use machined alloy cylinders and drill blank shafts for silky smooth action.

Rugged, yet light, the suspension gives you all the adjustability of full size, full race buggies. The A-arm/Ball joint design allows precise camber, caster, ride height and spring rate tuning. Even anti-roll bars and a VariLok dif are included.

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Fokker .... *Continued from page 26*

shape and drilled to match the plastic protrusions provided at the forward gun mounts. These brackets should be screw-mounted to a block bonded into the hatch.

At this point, a thorough check of all flying surface alignment should be done. Use the body vertical centerline as a reference. This then makes the vertical sternpost on the centerline. The body upper longerons are parallel to the body horizontal centerline. Measure to see that each wing tip is the same distance from the sternpost and that the root sections of the two wings are parallel to the body upper longerons. The horizontal and vertical tail surfaces are checked in similar fashion. Any corrections to be made should be done before the covering is applied.

Covering is the most satisfying step of building any model. The shape becomes complete and the structure is firmed and you feel almost finished. The model was covered with silk and clear butyrate doped prior to adding any color. Some new model covering fabrics could be used, but they are heavy. Plastic covering is out for the scale fan, but MonoKote can be dulled by spray painting . . . I recommend silk.

Color selection affects the model appearance more than any other single item. I wanted to do a hexagon camouflage job and found it fairly easy to do. My only regret is that the camouflage works too well. The lines of the model are broken up when viewed against almost any background . . . this is a difficulty when taking color photos. The underside of the model is pale blue and views from below show off the lines very well. If I refinish the model, I intend to use dark green upper surfaces, similar to the contemporary over-painted Fokker D-VIII, pale blue lower surfaces, and white rudder. All crosses have a white outline.

For those who wish to finish in hexagon, the following ideas are suggested. The size is as depicted and the colors are best taken from the "Munson Pocket Encyclopedia 1914-1919." There are patterns of either four or five colors. Work out a pattern, noting that most figures are six-sided with an occasional five-sided figure. Make a template of about five of the figures and then practice laying out your pattern using the template. When you can get a surface to look like the pattern has been machine printed on material, then you are ready to do the model. The pattern is applied to the airplane in a regular fashion, as the printed fabric was applied with the warp of the cloth spanwise. The first color coat should be of the lightest of the chosen colors. The subsequent colors are applied with a small brush held in a steady hand. Don't rush it. It took about twenty hours to put the pattern on the model.

The crosses are hand-painted on. I like the narrow crosses shown, although the real aircraft had narrow or broad crosses shown in my photos of the actual craft.

Flying is best done in the calm of the day with the customary taxi tests preceding, in order to try throttle, rudder and tail attitude while still on the ground.

The model, built in Seattle, was first flown December, 1968 at Langley Field, Virginia, by my good friend, Tom Strom. The day was cold and windy but other circumstances decreed that flight take place. The third flight that day was made downwind (not by choice) and into the rough, with very minor damage.

The model is now here in Seattle, and is still complete, but it has only been flown about ten times.

It does fly well and it is a smart looking ship with the added features of being unusual plus being an active combat craft of World War I. •

Magic . . . . . *Continued from page 19*

remain fairly steady because the one-way autorotation bearing allows the main rotor to freewheel when the engine sags. As the engine torque oscillates, the tail rotor rpm would oscillate in unison. Therefore, the torque compensation remains fairly steady. However, with the driven tail rotor, the tail rotor is always geared to the main rotor. When the engine sags, the torque reduces, but the tail rotor rpm does not reduce because it's connected to the main rotor now. Consequently, the nose yaws to the right suddenly. When the engine surges, the nose yaws left sharply. Therefore, at 100 feet away, the model's nose was yawing suddenly 90° to the left, and suddenly 90° to the right. But I kept the airspeed up, so the weather vane effect helped steady the nose. It was then landed in one piece. Therefore, if you do not practice the FAI 180° autorotation maneuver, there is really no need for a driven tail rotor system.

The Enya 60XF-4H comes in a ringed or non-ringed version. I used the Aluminum Chrome non-ringed version. Similar to an ABC engine, it needs to reach operating temperature for the piston/sleeve assembly to slide smoothly. It has so much compression, I have to loosen the glow plug before every start. I also have to use

the car battery to crank the engine. The front facing engine design on the Magic doesn't make it easy to remove the glow plug. The ritual involves removing the canopy, then inserting a long-handled 8mm socket wrench. Once the engine starts, pop the canopy back on. The glow plug wrench that comes with the Kyosho Concept kit is perfect for accessing a Magic's glow plug. Also, with a forward facing engine, you need to mount a glow plug extension permanently to the model. The kit includes the extension.

The Enya carburetor has three adjustments. A hi-end needle valve, a mid-range adjust lever, and a low-end air bleed adjust screw. We have found the factory set low-end air bleed setting is perfect. The hi-end needle valve should be about 1-1/2 to 1-3/4 turns open. The mid-range lever should be leaned out completely, which means push it toward the minus sign on the carburetor (We played with two Enya 60Xs, on two different helicopters, both required the same settings.) From idle to full throttle, there should always be plenty of blue smoke. If not, your Enya 60X is set too lean. It is better to set the top end slightly on the rich side because after five minutes of flight, the engine will lean out slightly by itself. The fuel intake nipple should be loosened and rotated 90° to the horizontal position. Some Enya engines burp occasionally. If yours does, then rotate the fuel nipple. This should provide a better draw and cure the burp.

The 60XF has a tremendous amount of mid-range torque. But when we punched in full collective, the top end pitch needed to be reduced from the manual suggestion of 9° to 7° to prevent bogging down. I used the stock Schluter 50924 muffler that the Magic is designed for. We believe if a tune pipe can be fitted to the engine, we can extract at least an extra 10% in power. The Schluter silencer is not a tune pipe, so it does sap some engine power. At David Ramsey's suggestion, I opened up the rear end of a Schluter muffler. Inside there are three baffles, each has six holes on it. Each hole has a small lid covering it. If you pry the lid open completely you will reduce the back pressure. It does give very slight power gain, and without any noise increase. If one of the three baffles is removed, then you would get slightly more power, but you would start to hear the noise increase. So far I have tried Fox R/C Long and Enya number 4 glow plugs, both give equally good result on a 10% synthetic fuel.

Four different sets of main rotor blades were used in the experiment; the stock Schluter wood blades, Robbe's fiberglass blades made by Alex Gauss, Hybrid Hobby MFG's regular Magic wood blades, and Hybrid's high performance Magic wood blades. The stock wood blades are not weighted. The control response is good, and the stability is good. Robbe's fiberglass blades (retail $139) are about 200 grams

each. They are a super hi-tech design. They have three different airfoils from the blade root to the tip. A reflexed section on the inboard to generate a nose-up pitching moment to cancel out the nose-down pitching moment generated by the high lift airfoil section at the blade tip. This minimizes the loads transmitted back through the swashplate to the servos. At the 70% span location, a symmetrical airfoil is used. At the tip, a cambered high lift section is used. (More technical discussions on this blade were discussed in the November and December, 1989 *Model Builder*.)

The blade tip is very highly swept to reduce profile and induced drag. Flight tests on the Magic reveals they are indeed an excellent design. The swept tips make them slightly quieter. The 200 gram weight improves the Magic stability even further. The best part is that each blade is beautifully gelcoated in white and each pair comes pre-balanced. The three airfoils all blend smoothly into each other. Alex fully exploited the advantage of fiberglass molding technique. If it were just a constant chord, constant airfoil rotor blade, then a wood blade would do just as well. These fiberglass blades are a work of art to look at. If you have ever wanted a set of fiberglass blades, these are the ones to get. These glass blades come in two versions: long and short. They both have 14mm root thickness, so they fit Heim, GMP, Schluter, Hirobo, and X-Cell. As Kalt main rotor blade grips have an 18mm gap, you need to add shim washers.

If you want inexpensive blades, but with high performance, then the Hybrid Hobby high performance wood rotor blades perform very well. Our first aerobatic flights were done with the standard Hybrid wood blades (retail at $22.95, slotted ones cost slightly more). They are an identical copy of the stock Schluter blades. Mine were slotted and weighted with Hybrid Hobby's metallic epoxy weight kit. Each blade came out at 180 grams. With the 180 gram blades, the Magic looped inside, outside, and rolled very agilely. We recommend that you use weighted blades; 180 to 200 grams, on the Magic. Heavier blades improve the longitudinal and lateral damping, which reduces the phugoid and Dutch Roll phenomena on all helicopters.

Hybrid Hobby's high performance wood blades are of the same weight, except the airfoil is thinner. The stock version is about a 13.5% symmetrical airfoil (so is Schluters). The high performance version is about a 10% symmetrical airfoil (retails for $32.95). The stability is still there, but there is a slightly snappier transient response simply due to a slight change in the lift-curve-slope. These wood blades come slotted, and include steel rods for weight. Or, you can buy Hybrid's metallic epoxy for weight. By the way, Hybrid also makes 10mm main rotor shafts, rotor head cross shafts, flybars, and canopies for all the Schluter helicopters and most other popular helicopters. Call Mr. Ray Stonge at Hybrid for a catalog, (203) 276-8465. Ray does exquisite custom paint jobs, too.

For all four sets of blades, we found that 1700 rpm gives the best stability and controllability. The helicopter and engine both sing charmingly at 1700 rotor rpm. Below 1600 rpm, the control response began to get slightly mushy. Therefore, we recommend 1600-1700 rpm. At this rpm, combined with the 180 gram blade, we can kill the engine in hover, and still have sufficient inertia to hover for one to two seconds, then land. At 1500 rpm, you need about 4° pitch for hover. At 1700 rpm, you only need 2.5° pitch for hover. At 1500 rpm you can have the hi-end pitch set to 9°. But at

1700 rpm, you can only set the top-end to 7°. From a theoretical stand point, it's always better to operate at lower pitch settings because most airfoils have constant drag coefficient from O° to 4°. Then, the drag coefficient grows slightly between 4° and 6°. The drag grows rapidly above 6°. Thus, if we run the rotor at 1700 rpm, we can minimize the blade drag, which means less engine torque needed for the same flight conditions. However, from a mechanical setup point of view, this is bad. Less pitch travel means that for a small mechanical movement of the swashplate we get a big change in the blade force. This emphasizes the need for more careful, and slopless set up. Maybe this is why Volker Heines, one of the German F3C team members at the World Champs, avoided high rpm. He used 1400-1500 rpm on his Magic at the World Champs.

The Magic comes with three sets of Hiller paddles; two thin ones and a set of thick, hollow paddles. For any of the three paddles, you should leave the flybar weights all the way out to get the best stability. To retain good controllability, use the large, thin, white paddles. This combination provides great stability and lively control. The slightly smaller, thin, white paddles also provide lively control response, but due to the reduced area, the control sensitivity is reduced very slightly. The thick black paddles give very smooth control, but also plenty of authority due to the large area. This paddle is for the beginners, but I have tried it, and it is very aerobatic.

If the Magic is built according to the instructions, the center-of-gravity will come out about 1/4 to 1/2 inch in front of the main rotor shaft. This is perfect for aerobatics. Slightly forward cg improves forward flight and longitudinal stability. I am using an SR 1200 mAH battery and six servos, therefore, my cg is about 1/2 inch forward, but as the fuel tank is located behind the main shaft, with a full tank the cg will be almost on the shaft.

As the pictures show, I cut away part of the canopy that covered up the muffler. The left side of the canopy was sitting too close to the muffler. The heat melted part of the canopy. In the last issue, we suggested you machine the muffler exhaust stack shorter and extend the wood bulkhead a quarter inch on the left side. Then the muffler would not be so close to the canopy. From an aesthetic point of view, if the groove on the canopy for the bulkhead is not there, maybe the canopy will look even prettier.

Like the Champion and the Scout, all the plastic control bellcranks are supported on Delron bushings instead of ball bearings. Robbe sells ball bearings for the Magic, Champion and Scout, but they are over ten dollars a piece. You need about twenty of these bearings (8 for the four bellcranks, and 12 for the mixing arms). David Ramsey says these bearings are standard 1/8" I.D. and 1/4" O.D. flanged bearings that you can purchase at a bearing house for slightly less than $10 each. Do we need to replace the Delron bushings with bearings? I wouldn't. My bushinged bellcranks and mixing arms are smooth and slopless. The trick is to take a sharp, new knife to clean out the burrs at the inner lips of the white Delron bushings.

The #3529 bolts that go through the bushings also have microscopic burrs on the bottom side of the hex head. Take a jeweler's file and remove the burrs. Now the bellcranks and mixing arms should be silky smooth. Before the ball links and control rods are connected to the bellcranks and mixing arms, you should move each bellcrank and mixing arm by hand to make sure they are free by themselves, then the combined control system will be free. Tight control and friction will cause your high quality servos to hum.

When bolting down the #3529 bolt through the mixing arms, add a drop of CA glue first, otherwise the bolts can vibrate

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loose. That would be a major disaster. However, the four bellcrank-supported swashplate can have one bellcrank on each side fail and still have perfect control. Two of the four bellcranks are redundant. They are there to provide a push-pull control system for a more balanced set up. The steel ball at the end of the 90° L-arms on the flybar for the Hiller paddle control is slightly large. Take a 400 grade sandpaper or an emery cloth and polish those particular steel balls until the plastic ball link moves freely on them.

The #3167 planetary gear should be cleaned and greased after every ten flights. The reason is that it is a bell housing with gear teeth on the inside surface of the bell (see picture). In normal use, the dust and dirt will be thrown against the inner wall due to centrifugal force. Soon the debris accumulates and fills up the groove between the teeth. This would pose problems for the pinion gear that runs on them. Consequently, the #3167 plastic planetary gear would strip. To clean the inside of #3167, just use a very small toothbrush. Afterward, put on some automotive speedometer cable grease.

Now let's go through the settings on my Futaba 9VHP for the Magic. For people who are also interested in using 3 or 4 servos CCPM, I used the large 4-arm Futaba servo arm. The outermost hole is used. By the way, not all model helicopters can use CCPM. The Magic requires no modification for implementing CCPM. Many other models require major modifications to implement CCPM. The four servos for the CCPM are mounted in the existing Magic plastic servo tray as shown in last month's *Model Builder*. The center support rail for the four servos is cut from an old Schluter black plastic tail rotor blade. The advantages of CCPM are: 1. It eliminates mechanical collective and cyclic pitch mixing; 2. Less linkages and thus less slop; 3. All the control throws can now be adjusted electronically at the transmitter; 4. The torque required to raise or lower the swashplate for the collective control is shared by four servos, this reduces work load and wear; and 5. Similarly, pitch and roll cyclic controls are each handled by two servos instead of just one.

On my 9VHP, I picked the H-4 swashplate mode. 'Pit' is set to 70%, 'ail' is set to 65%, and 'elv' is set to 55%. This gives almost the full swashplate movement. As you can tell, I like to have full authority over the helicopter and do aerobatics. The 'ail,' 'elv' and 'rud' dual rates are all set at 80%. 'Ail' and 'elv' exponentials are set at 16%, 'rud' exponential is at 20%.

The Futaba 9VHP has five separate pitch curves: normal, idle-up 1, idle-up 2, throttle hold, and invert. If you don't have a programmable radio, then try -5° for the low end, 3° for hover, and 8° for the top end. This gives about 1600 rpm for the main rotor. For people who have the 9VHP, the pitch curve shape for all my pitch curves, except invert, are shown in the drawing. My normal and idle-up 1 have

the same pitch curve, but different throttle curves. For these two, the Lo pitch setting is 86%, and Hi setting is 40%. For idle-up 2, the Lo setting is 95% which gives about 1° more for sustaining inverted flight without hitting the invert switch. The Hi is set at 40%. For throttle hold, Lo is set at 100%. This give an extra 1° on the bottom end for doing a steep auto. The Hi is set at 100%. This gives more high end pitch than the normal pitch curve which helps cushion the flair at the bottom of the auto.

The different throttle curves are shown in the drawing. One of the very nice features of the Futaba 9VHP is that the throttle can be increased as the throttle/collective stick is pulled back (look at my idle-up throttle curves). This allows you to have minimal engine power at 0° collective pitch, and more power at positive and negative pitches. This allows inverted flight by using idle-up 2 switch, and without hitting the invert switch. So far only Futaba 9VHP and JR PCM10 have this capability of U-shape throttle curve. To do this, on the 9VHP, my throttle rates are set at 30%, 35% and 89%, respective, for the normal, idle-up 1, and idle-up 2. The throttle "curve" for idle-up 1 and idle-up 2 are both set at +100.

As we have pointed out in the last issue, it would be even better if there is a programmable rudder mixing curve for each of the five pitch curves. Then we can have increasing positive pitch as the main rotor blade goes into negative pitch.

Notice that all the pitch curves and throttle curves on mine are programmed to have very shallow slope near the center stick, and steeper slopes on either ends. This desensitizes the throttle/collective control at the center stick position. The benefit is during hover; you would like the throttle/collective to be less sensitive, which refines height control. I also opened up the back of the transmitter and loosen the stick tension. The two control sticks are also shortened slightly by adjusting the knurled stick end. Unlike flying airplanes, when we fly model helicopters, the control sticks are rarely left alone for more than one second. We are constantly moving both sticks, thus, loosening the stick tension helps reduce P.I.O, and may improve your flying. Try it! On all my transmitters, the stick tensions are set very loose, so you will not feel a strong "breakout force" when moving the sticks away from the center.

The Futaba programmable 9VHP 1024 PCM already has almost all the features that you may desire. But, Steve Helms, how about adding a two-position toggle switch throttle hold? Throttle hold-1 will lower the engine to idle for autorotation practice, and throttle hold-2 will kill the engine for doing autos in competition. Once the throttle hold engine idle speed is set, you do not want to change it. For example, at the recent F3C World Championships, Robert Gorham received zero points for his beautiful 180° auto because the engine did not die. If he had two throttle holds, then the throttle hold-2 can always be set to kill the engine. This might even be a good, safe, emergency feature, too.

Well, we think that we have given a very thorough review of the Schluter Magic, the Futaba 9VHP radio, and the Enya 60XF-4H. Five people have test flown the Magic, and unanimously agree the combination flies great! The design definitely has "finesse." It only took me 60 hours to build it and another 10 hours to set it up! The result is well worth the effort. It has been reported in a British magazine that it only took them 20 hours to build. But with $1700 worth of value invested in this flying machine, let's take our time and build it carefully. The Magic is a very stable and aerobatic machine, but it should be built by someone with experience. The instruction is not geared toward the beginners. It is a very well engineered and sophisticated

WIN A RADIO!

- The Spectra PCM Series radio control system is designed for the intermediate or advanced flier. The Airtronics Spectra offers compact size, light weight, and superior aircraft performance that outdistance other radio control systems.
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- Features on the SP7P include servo reversing on all channels, adjustable travel volume, plug-in RF module, modular transmitter battery pack, RF output meter, programmable fail-safe with inhibit, high-visibility LED indicators, dual conversion FM/PCM super narrow band receiver, dual rates, and low transmitter battery voltage alarm.
- Specifications worth noting on the SP7P by Airtronics include snap roll adjustable inputs; dual rate on elevator and aileron; automatic dual rate on rudder; adjustable travel volume on elevator, aileron, rudder and throttle; adjustable low throttle trim; flap/elevator mixing; elevator/flap mixing; aileron/rudder coupling; exponential on aileron, elevator and rudder; pulse mixer for flaperon, elevon, or V-tail models.
- The SP7P is a 7-channel digital proportional narrow band radio system. It weighs 37 ounces, and has a power output of 600 MW. The frequencies available are 50, 53, and 72 Mhz. Modulation is FM/PCM. Power supply is from a 9.6-volt NiCd, with a current drain of 230 MA. Temperature range is 0-160 degrees, and the pulse width is 1.5ms (nominal). The receiver type is a dual conversion FM/PCM super narrow band.

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Void where prohibited

machine. A beginner will enjoy flying it, but he lacks the expertise to set it up properly. Therefore, we recommend the beginner start on something less costly and simpler. We recommend this great helicopter to the intermediates and the experts without hesitation.

The Futaba 9VHP has provided trouble free operation. After reading the instructions twice, and playing with the programming many times, the unit became very user-friendly. Again, the 9VHP is not recommended for the tyro, unless he has someone who is very knowledgeable about the 9VHP to set it up for him. Even for someone who knows how to fly helicopters well, it would take at least 10 hours to be totally comfortable programming it, but, put the 9VHP in the hand of an expert, and he can do magic with the programming features to enhance any model helicopter's handling characteristics. The F3C World Champion, Yukihiro Dobashi, used a Futaba 9VHP to win the World Cup in 1989. We would love to have a peek at his program settings.

As for the Enya 60XF-4H Aluminum Chrome engine, it has served well. Many people suggested replacing the Enya carburetor with a more easily adjusted Super Tigre carburetor. If you use the settings that we gave earlier, then you should find the 60X runs very reliably. Of course, we always have a thirst for more top-end power. If we could squeeze another 10 to 20% on the top-end, then the Magic could break the 60 mph barrier. Maybe we will install a tune pipe and use 15% nitro fuel in the future. In Japan, all the F3C pilots use 30% nitro fuel. Instead of using an Aluminum Chrome engine on the Magic, maybe it's better to use a 60XF-4F ringed engine. Then it would be easier to start on cold winter days.

Stay tuned, next month we will have the World Championship equipment list. We will tell you the model, the radio, the rotor head, blade length, weight, gear ratio, pitch settings, . . . used by 41 of the world's best. And also examine the Kalt Cyclone II. In the next issue we will discuss the latest products exhibited at the International Modeler Show in Pasadena, California. •

Elec Power *Continued from page 21*

you are charging a lead acid battery, always clip the automotive charger to the battery before you plug in the charger. Unplug the automotive charger before you remove the charger clips from the battery. If you are using the battery to charge a flight pack, always clip the charger to the charge battery first before you plug the flight pack into the charger. Disconnect the flight pack first before unclipping the charger. The general rule is: Clips go *on* first. Clips come *off* last! The safest procedure of all is to have the battery equipped with a power cord so that chargers can be connected or disconnected four to six feet away from the battery. I have to confess that I am not very consistent about that, though I should be.

Back to Grunstadt! VTH had a very impressive display of their books on electric flight. The photo shows five of the titles: "Solar Modellflug" (Solar Model Planes, 25 DM); "Electroflug-Modellbau" (Building Electric Model Planes, 25 DM); "Experten-Tips Electroflug" (Expert Tips for Electric Flight, 14.80 DM); "Der Akku im Modellbau" (The Batteries in Model Building, 14.80 DM); "Electroflug fur Ein- und Umsteiger" (Electric Flight for RC Fliers and Beginners, DM 14.80). In addition to these titles, "RC Electroflug" (Survey of RC Electric Flight, 9.80 DM), "Electro-Segelflugmodelle" (Electric Sailplane Models, DM 28), and "FMT Bauplan 1990" (Building Plans from FMT 9.80 DM) are available. The building plans book has an excellent selection of electric planes to build, and even includes my Aqua Sport! I had not known the plans were available in Europe! I have the RC-Electroflug survey book, and it is excellent, with articles ranging from beginning electroflight, solar flight, electric ducted fans, to motor design and performance. Seven titles that are on electric flight from one publisher! If you are interested in these, contact VTH (Verlag fur Technik und Handwerk), Postfach 1128, 7570 Baden-Baden 1, West Germany. About 1.70 DM is $1, add about $3 for postage. These books are well illustrated, so if you have had no German at all, the illustrations and charts will still give you a lot of information. If you have had a couple of years of school German, most of the text will be readable, though you will need a college level German dictionary for some of the words. I recommend the Langenscheidt New College Dictionary (about $20). It would be great to see these translated into English, and I think there would be a good market in the U.S. Incredibly enough, another publisher, Neckar-Verlag, also has four titles that I know of on electric flight, I will talk about them next time. The German electric flight enthusiasts have an amazing amount of information available to them!

There were several interesting planes on Sunday at Grunstadt; Fridtjof Schussler's ME 109 was outstanding. Fridtjof built it from an Engel kit (Germany) and powered it with a Keller 50/11 and 20 sub-C cells. All up weight was 3.5 kilos (7.7 lbs.). This is a .60 size kit and it flew very well and smoothly, as a scale plane powered by a gas .60 would. It is fully aerobatic, four channel, with a throttle designed by Fridtjof, who is an electrical engineer. The throttle uses a 2 kHz pulse rate, which, as those who have followed Bob Kopski's column know, is best for efficiency. Fridtjof's demo flight was at least eight minutes, it may have been as long as ten minutes. I know he took off before a couple of other electrics, and he was still flying well after they landed. It was fun to watch, and the plane looked like it was easy to fly.

A very nicely done Udet biplane flew in a very scale-like manner, this may be the one Fritz Geist flies, but I did not find out. This was a 40 size plane, so it probably was flying on 18 cells. Biplanes make very good electrics, in all sizes, the largest I have seen is 1/4 scale, the smallest (my Tabloid, many years ago) was 24-inch span.

There was a stand-off scale jet at the meet too, powered with a prop in front, not a ducted fan. It flew like a jet, fast and aerobatic. I did not find out who the pilot was, though I am pretty sure this is the mini-Alpha-Jet from Topp-Modelle. It is sold by Scale Modell Technik, G. Bald, Am Vossholz 12, 5870 Hemer. The price is DM 150, span is 40 inches, flying weight about 5 lbs. It is advertised for 15 to 25 size gas engines, so the Astro 15 or 25 would be equivalent, with 12 to 14 cells. The fuselage is already made, of ABS plastic.

There were two Telemaster 40 planes flying, with a 73-inch span, using Keller 50/11 motors and 12 cells. They weighed 5.5 lbs and flew quite well. I have had some

readers ask about the Telemaster as an electric, so there is your answer! The Telemaster 40 is available for $68.50 from Hobby Lobby. The Astro 40 on 18 cells will make it perform very well. Last, but not least, every contestant went home with a bottle of wine from the local wine growing district. This was "mit pradikat" wine, the best. There were cases of it! The photo shows the display, my estimate is about 200 bottles. No wonder Grunstadt is a popular meet!

Howard Lazerson wrote to me about his Thermal Charger, kitted by G.M. Precision Products, 510 E. Arrow Highway, San Dimas, California 91773. This is a cute pusher type plane with a V-tail spanning 60 inches. A Leisure 05 motor is included in the kit. Howard likes the Thermal Charger a lot, and so have several other readers that wrote to me. Howard originally powered his with a direct drive Astro 15 and 10 cells, which gave a fantastic rate of climb. He liked it that way, then put in the Leisure 05 motor as he needed the 15 for another plane. Howard used six 900 mAH Sanyo red cells, and the climb is still very good, at a 30 degree angle. It is quite light with the Leisure motor, and thermals and slope soars very well. Howard uses 15-20 second motor runs to get 8-9 full power climbs. With these and some lift, Howard can fly to the limit of his 250 mAH receiver pack on just one motor charge. Howard suggests using a Cox 6/4 prop rather than the one supplied to get better climb, and omit the stringers in front in favor of cross grain balsa or ply doublers. He says it is very easy to fly and would make a good trainer. An advantage of pushers is no prop or motor shaft damage! Thank you, Howard, for the info. Till next time, enjoy life with electrics! Mitch Poling, 7100 CSW/MC, Box 734 PSC 2, APO NY 09220-5300. •

Soaring *. . . Continued from page 38*

myself!"

Well Blaine, here's what I got:

First of all, I present a small excerpt from a letter from Les Sparkes, of Essex, England. Les writes, "I know Sean Walbank described the BARCS (British Association of R/C Soarers) Percentage Slot (F3J) rules to you, but I wondered if you knew that it requires the use of a matrix system to sort out the competitors and their frequencies?

"Enclosed is what I hope will explain better than my writing ability is able. Although the material is old, the principles are the same. . . ."

What you are looking at in the charts is a simple way of making sure no two guys on the same frequency are in the same round. This is very important because in F3J (theoretically) as many fliers can be in the air as there are different frequencies. Although for practical limitations of field size, crowding in the sky, hand towing fouls, mid-airs, etc., a maximum of seven to nine fliers per slot or "heat" should be established. I would suggest that for AMA contests, in the matrix, each alpha character could represent two channels (e.g. A = ch.12 or ch.38, B = ch.14 or ch.40, etc.). The sequential numbers are contestants who will always keep the number they get in the first round. Add slots as the number of fliers

increases, add letters as the number of frequencies increases.

7 PERSON, 9 SLOT MATRIX 63 FLIERS,
ROUND ONE:
FREQUENCIES USED

SLOT	A	B	C	D	E	F	G
1	1	2	3	4	5	6	7
2	8	9	10	11	12	13	14
3	15	16	17	18	19	20	21
4	22	23	24	25	26	27	28
5	29	30	31	32	33	34	35
6	36	37	38	39	40	41	42
7	43	44	45	46	47	48	49
8	50	51	52	53	54	55	56
9	57	58	59	60	61	62	63

ROUND TWO:

SLOT							
1	1	9	17	25	33	41	49
2	8	16	24	32	40	48	56
3	15	23	31	39	47	55	63
4	22	30	38	46	54	62	7
5	29	37	45	53	61	6	14
6	36	44	52	60	5	13	21
7	43	51	59	4	12	20	28
8	50	58	3	11	19	27	35
9	57	2	10	18	26	34	42

ROUND THREE:

SLOT							
1	1	16	31	46	61	13	28
2	8	23	38	53	5	20	35
3	15	30	45	60	12	27	42
4	22	37	52	4	19	34	49
5	29	44	59	11	26	41	56
6	36	51	3	18	33	48	63
7	43	58	10	25	40	55	7
8	50	2	17	32	47	62	14
9	57	9	24	39	54	6	21

Note the logical advancement of fliers in each column so that the fliers in each slot are different in each round. Never mix fliers between vertical columns or you will have frequency conflicts! Thank you Les from Essex!

And now, from Hawaii, a very enthusiastic letter from occasional *MB* contributing writer, James N. Martin, of Pukalani, Maui. This is the first ever sorta-F3J event flown in the USA of which I am aware.

"Dear Bill; It's great, terrific: F3J type contest as covered in the RC Soaring column in the August 1989 issue of *Model Builder*. Last October 28 we staged an F3J fun fly, Maui style. Participation was excellent, each contestant was able to match his skills in head-to-head competition with weather conditions equalized.

"The format: Class B, hand launch. (Oh yes, we hand launch off the slopes of Mt. Haleakala.) Contestants were grouped into slots according to radio frequencies with two tries. Three groups of five contestants rotate 10-minute time slots through the day's weather. Spot landing points were minimal and thus eliminated Kamikaze type landings. All points were normalized to the high score for each event. Ten-minute flying slots were on the half-hour,

allowing time to check position and 'talk story.'

"At the final fly-off, the Top Guns of each group were on the line in head-to-head competition to determine the Top Kick. Again points were normalized to the high man's score of 1,000. Top Kick: Dale Collier; Top Guns: Matthew Collier, Jim Martin, Kevin Aoki, Dave Phillips, and Dennis Brittain.

"Great fun with positive comments. Thermals, James N. Martin."

AIRFOIL OF THE MONTH: SELIG-DONOVAN SD7032

This airfoil profile comes to you courtesy of *Soartech #8* published by Herk Stokely, 1504 North Horseshoe Circle, Virginia Beach, Virginia 23451. Cost is $15.00 postage paid, or $20.00 if you wish to receive *Soartech #9* when it is published.

Soartech #8 includes the highlights of over two years worth of research invested by Michael Selig, John Donovan, and David Fraser at Princeton University. It includes the experimental test results of over 60 wind tunnel "models" of 54 different airfoils that are perfect for R/C soaring, and over 160 performance polars from these 60. If you can't find an airfoil to love in this volume, you should find another hobby! *Soartech #8* is the one source of airfoil data that I would recommend above all others. If you haven't been able to find airfoil books up till now, your search is over, get out your money.

The SD7032 is a perfect choice for your next thermal duration competition sailplane. Soartech rates it among the best. It can pull lift coefficients as high as 1.2 at Reynolds numbers as low as 100,000, it shows low drag coefficients all across the normal useable lift range, and in general just looks right. It can even keep a good L/D ratio at Reynolds numbers as low as 60,000 (i.e., thermal floater types or hand launchers). I read in the PASS newsletter that it may have as much as a 20% better L/D than the old standby E214. Soartech only admits to "generally better" performance.

Flaps are useful with the SD7032 to extend the high speed range. Flaps are to be used only in the reflexed position, 21% of chord, minus 3 degrees deflection recommended. You will have to make this one foam core, however, as that thin, cuspy trailing edge is too fine for the normal wood rib construction techniques. Also pay attention to surface irregularities. For maximum performance, no bumps or flat spots!

As always, I want your feedback! Let me know if you try this section.

It is rumored that Ace R/C, Inc. is coming out with a two-meter sailplane called the Easy Eagle which uses this airfoil with turbulated open structure wings. Initial grape vine info says its a really good flier with a great low price. Stay tuned.

THAT'S ALL FOR NOW

Rats, I've taken up all my allotted space! I've got plenty more for next time, so stay with us, it gets better! Thermals to all, Bill Forrey, 3610 Amberwood Court, Lake Elsi-

nore, California 92330, (714) 245-1702 (after 6:30 p.m. Pacific Standard Time). •

CL . . . . . *Continued from page 61*

to have the up-control line toward the rear of the plane (this can be accomplished by turning the bellcrank in the plane so that the pushrod arm is facing the inboard tip). Summing up, I would suggest separating the leadout exits by approximately the amount you find likely to keep the line clips from tangling, if you use leadouts (the Ringmaster is about 2 inches). A typical combat plane might be 1 inch. If you don't use leadouts running the lines inside the wing as is done on many racing planes, use only one exit hole for convenience.

Horsepower:

A great many line tension problems can be solved simply by having a strong, steady engine run; conversely, many line tension problems at high elevations are simply the result of heavy airplanes with weak engines. It's amazing, for example, how many precision aerobatics airplanes were transformed from dogs to winners simply by swapping a .60 in for the .40!

With this in mind, note that the events which use virtually no rudder or engine offset at all—and have since before line rake's importance was generally understood—are the high-powered events like combat and racing. Now, with line rake being better understood, practitioners of these events are able to come closer to the optimum flying characteristics through adjustment of line rake. With plenty of horsepower, the idea of engine offset or rudder never even comes up.

Tip weight:

Tip weight is a factor in line tension, particularly in precision aerobatics, carrier and scale aircraft. However, for most types of planes, tip weight is primarily of value at the point of takeoff. Once a plane such as a combat or racing plane is airborne and up to speed, tip weight is largely immaterial and in some cases undesirable. For such planes, tip weight is a necessary evil which prevents the planes from being unruly creatures during takeoff.

Engine offset:

Engine offset is probably slightly more valuable for providing line tension than rudder offset because its effect is more constant than rudder offset. For most planes, particularly sport/stunt-type planes, a little engine offset will do no harm and may help tension a little. Beware too much; it can provide unnecessary pull and, with combat and faster sport planes, may actually work against line tension by causing the plane to "bounce" on the end of the lines.

(As if to be the exception that proves the rule, engine offset used in a radically different way than is common actually is the key to success of some of the more outlandish designs in CL model aviation—those of the mad scientist Rich Porter, of Salem, Oregon. Rich is famous for flying precision aerobatics with fairly large, light planes using extremely small engines (.020, .049 and .10). Rich's .049-powered "Ridiculous" was published in *Model Aviation* magazine. These planes use something like 20% offset. However, unless you've done considerable research as Rich has done, it might be best to leave science to the scientists.)

Rudder offset:

The chief disadvantage to rudder offset probably is that it works best when it's needed least. When the plane is going slow, struggling with a poor engine run or climbing vertically and losing speed, the airplane needs its tension the most—and because the plane is going slow, the rudder isn't doing much. When the plane is going fast the rudder is working like crazy—but a fast plane will have tension without any help!

Furthermore, the rudder is an inefficient means of pointing the plane outward because it acts as a brake as well as a control surface. Better to use another method of turning the plane—one that works all the time, no matter how fast the plane is going and one that has less of a negative effect on the plane's aerodynamics.

Can you guess what that method is? Yup. Line rake.

TIPS AND RIBS

A few odds and ends need to be mentioned.

First, congratulations to three new members of the North American Speed Society's 200 mph Club!

Loren Howard, Len Adachi, and Billy Hughes all have broken the magic barrier with OS .65-powered D speed ships in 1989. Loren did it at the Northwest Regionals in Eugene at 200.81 mph. Len hit 205.87 mph at the Tri Cities, Washington Nats, and Bill did it at the same contest, checking in at 206.10.

There now are 30 members in the club. The earliest on record is the Langlois/Schubert/Marsh team, with a 200.37 mph flight in with a .65-powered plane at High Point, North Carolina, in June of 1974. The fastest speed on the list is the 218.16 mph flight of Nick Sher with a B speed plane in 1982.

A couple of readers responded to a recent column about handles which mentioned the U-Reely.

Orin Humphries, of Lynnwood, Washington, writes:

"The U-Reely was an era in our development, a stepping stone. We started out with them for convenience, but as we progressed, the lines were too far apart for good aerobatics. We pushed the handle by making a line spacing limiter out of a coat hanger, but soon moved up to a small Hot Rock. We soon were spacing those leadouts closer together with a couple of line connectors. It 'geared down' the controls.

"On a related subject, I would like to buy a couple of examples of Obie's handles. I never bought one when he was alive, assuming he'd live forever, I guess. Can you suggest how I might advertise for them?"

In answer to Orin, I should clarify that to my knowledge, Oba St. Clair's spring-rewinding handle was never produced commercially. I believe that it was a handle Obie himself used. If I implied in the previous column that those were sold, it was in error.

Joe Wagner of New Wilmington, Pennsylvania, one of CL model aviation pioneers, had more to say about the U-Reely and some other matters as well:

"I can tell you about U-Reely handles; I was a friend and occasional flying assistant of Jim Walker's back in the Good Old Days, and often used a U-Reely handle.

"In the late '40s I toured America with a hobby show sponsored by the Model and Hobby Industry Association, demonstrating control-line models such as Comet's 'Rookie Trainer,' PDQ's 'Flying Circus,' and Top Flight's 'Zing.' Most of this flying was done in impromptu locations such as store parking lots. I even flew once in a street intersection. For this kind of flying, the U-Reely was indispensable.

"I frequently used the self-launch technique. It was a little tricky for me because I'm strongly right-handed and both the launch and recovery (for counter-clockwise flying anyway) are best done with the U-Reely held left-handed. Also, had to do some mighty quick footwork at the start and end of each flight to keep up with the model when the line length was short.

"I never saw a metal-cased U-Reely. The first versions were wood. (A friend of mine still has one of the very first wood-frame U-Reely handles.) However, the majority of the U-Reelys were made from molded 'bakelite' plastic.

"A version of the U-Reely was available with an electric switching arrangement and insulated steel cable lines powered by a pilot-held battery. The airplane contained a relay, which switched the '2-speed' igni-

tion points of an Ohlsson .23 or Forester .29 from high to low speed.

"I still have the U-Reely I used on the M&HI tours, and use it once in a while today. Establishing the 'correct' line length isn't difficult. My method is to paint markings on the 'up' line at various 'standard lengths'; about a 4-inch to 6-inch section painted orange or green is easy to see.

"The U-Reely's wide line spacing is not as bad as it appears, since as you move the handle some 'wrap' occurs around the circular drum. The handle's 'nose-heaviness' is annoying at first, but once you get accustomed to using the handle you don't notice it much.

"As long as I'm writing, I'll enclose a picture of one of my favorite U-control designs. This is a profile version of the WWII British 'Skua' dive bomber. My model is about 15 years old now, and is powered by an ancient McCoy .19. The big wheels permit flying from grass without much difficulty.

"The Skua's aerodynamics are much different from my usual U-control design characteristics (exemplified by my old Veco stunters like the 'Chief' and the 'Squaw'—for which I still have full-size plans available). I decided to give some ideas of my old buddy, George Aldrich, a try in the Skua. I used the same area and 'moment' proportions as George did in his 'Peacemaker.' They work quite well.

"The Skua won't turn as tightly as a flapped stunter, of course, but it's as good a 'sport stunter' as anyone could want. And it's a very 'forgiving' airplane that even a novice ukie flier can handle with confidence."

As always, questions, comments, club news and photos are welcome. Write John Thompson, 1520 Anthony Ave., Cottage Grove, Oregon 97424. •

Hannan ... *Continued from page 49*

Graham then constructed another, much lighter Aeronca, which did take off from the palm of his hand and flew for about 20 seconds. A series of R.O.H. models followed, including his current favorite, the Waco E bipe. It spans 6-1/2 inches, weighs 1-1/4 grams and is powered by a single strand rubber motor wound to 1600 turns, which yields about 29 seconds duration ... R.O.H., of course. ...

NEW AERO STAMP

The United States Post Office has recently introduced new postage stamps devoted to transportation. Included on the sheet are a stage coach, a "side-wheeler" steamboat, an early mail truck, and more to our taste, a Jenny-esque biplane, having mail sacks loaded into its front cockpit. Adorn your mail with something appropriate, for 25 cents!

MODEL BUILDING THERAPY

Robert Hutchison, an American living in Germany, has been confined to a hospital following surgery, and wrote a most moving letter from which we extracted the following: "Naturally, when I realized I was going in the hospital, I packed my building-board first, then my undies. As you have mentioned in your column and books, there is no better common denominator than model building. When the word got out in the hospital that there was an American on board, and that he was sitting in his room building airplanes out of sticks and tissue paper, it didn't take long for the kids to show up (skeptical adults too). The kids had never seen balsa wood, or tissue, or a rubber motor (can you imagine?). I had a bunch of real neat gliders (Ventura Tiger Squadron), and pretty soon everybody is building up a storm.

"We start looking for a place to fly (sound familiar?). But here we really got lucky! This is a "space age" hospital, complete with a cleared helicopter landing-pad that is about 1,000 feet square, shielded from the wind by buildings, and most times, deserted. My two boys are hauling in balsa wood by the chord, glue by the gallon, rubber by the mile, etc. (Lew Gitlow and I worked hard on this hoard; good straight-grained balsa, Japanese tissue, Pirelli rubber), but we are having a ball!

"One of the heartbreaking things about being in a hospital, for me, is seeing all the kids with their bandages, casts, and other worse things. Most of us 'oldtimers' are used to pain and isolation, but for a child, it's really rough. I'm not sure whether I'm a hero, or the devil's advocate; the nurses and doctors are all mumbling under their breath about overexertion and the glue-smears on the smocks, but I think not."

PISTACHIO POWERPLANTS

Few items featured in this column have attracted as much attention as Stefan Gasparin's subminiature CO_2 engines, cur-

rently recognized as the world's smallest reciprocating power units. We are pleased to present, slightly edited, Stefan's account of producing one of these precision jewels, which he entitles:

WHAT IS SMALL IS BEAUTIFUL

"Good results with CO_2 engines having displacements of from 6 to 18 cubic millimeters led me to build an even smaller engine with a cylinder bore of 1.5 millimeters and a stroke of 1.2 millimeters, giving a working volume of 2 cubic millimeters. These sizes were determined more by the tools which I have in my workshop rather than by any complicated reasoning!

"The design, drawn 20 times actual size, was very similar to the design of my larger engines, but much thinking was required to determine methods of producing the individual parts, and to prepare the necessary tools and fixtures. They required more time than the actual engine parts production.

"After I became accustomed to working with hundredths of millimeters as if they were tenths of millimeters, and to do everything necessary so that gadget surfaces, after machining seemed, under high-magnification, the same as if seen by unaided vision, the parts production was no longer a problem.

"The construction of the engine is identical to my other engines. The CO_2 gas is supplied through annealed stainless-steel tubing with an outer diameter of one-half millimeter. The engine's 0.6 millimeter ball-check-valve was obtained from a ballpoint writing pen.

"The overall dimensions of the engine are approximately 9 x 9 millimeters, and the crankshaft has a diameter of one millimeter, with an M1 thread on the end for securing the propeller.

"The cylinder features three exhaust openings of 1/2 millimeter, and the 3.2 millimeter diameter cylinder-head is engraved longitudinally. The valve seat and the piston are machined from ABS plastic. I consider the mastering of their production as the main contribution to the manufacturing of this engine.

"The engine's connecting-rod was machined with the aid of tool-steel bits cut by a numerically-controlled spark-erosion wire-cutting machine, providing an accuracy of better than one-hundredth of a millimeter. With these tools it was possible to turn the connecting-rod in one operation. Indeed it was simpler to manufacture the smaller engine parts than to avoid losing them!

"The aluminum-alloy CO_2 'fuel tank' has an outer diameter of 12 millimeters and a height of 15 millimeters and a volume of 0.9 cubic millimeters. Its weight of 1.1 gram represents half the weight of the entire propulsion unit, including the propeller.

"Before the engine was finished, I was convinced that it would run, but it was difficult to predict if it would have sufficient efficiency for propelling the chosen model. Therefore, the first tests were pleasant surprises! The engine fitted with 50 and 60 millimeter diameter propellers respectively, willingly achieved over 20,000 revolutions per minute, measured with an electric

tachometer.

"Even before completing the engine, I had chosen the model for it to power, the Czechoslovakian BH-7b racer, which has good proportions for CO_2 engine propulsion. It was constructed by my friend, Antonin Alfery, a most appropriate model builder."

So there you have it faithful readers, Stefan makes it sound quite simple, doesn't he? Of course we all know better, and congratulate this master-machinist not only for his abilities but for his modesty as well.

Since composing this article, he has made even *smaller* engines, including the one featured in our photo, which successfully powered Frantisek Barta's Pistachio Scale Lacey M-10. And not being one to rest on his laurels, Stefan Gasparin is presently working on an engine to power a 1/72nd scale Piper Vagabond being constructed by Mr. Barta!

SIGN-OFF

Model builder Bill Noonan recently returned from England, where he had the thrill of seeing the restored DH 88 Comet in action. He recalls that when the test pilot of the Comet landed the skitterish critter after its initial flight back during 1934, he was reported to have said: "Don't build any more." •

Free Flight *. Continued from page 59*

APRIL DARNED GOOD AIRFOIL—I.S.A. 571

This is another section from the pages of the Comprehensive Reference Guide to Airfoil Sections for Light Aircraft, and I selected it because its features are very compatible with sections currently in use in free flight power models. The high point is rather far forward at 30%, it has a slightly raised leading edge (Phillips Entry), a modest undercamber, and not-too-thin trailing edge. If I were building an F1C model, I would look very carefully at this airfoil or a slightly thinned version of it.

Initially tested in 1918 in the Instituto Sperlimentale Aeronautico, in Italy, it shows lift/drag coefficient well within the range of current free flight power models. Hope you consider it!

INDOOR COVERAGE CHANGES

For those of you who have been looking for the "Insiders" column, it will not be contained in the next few issues of *Model Builder. (For a further update, refer to the "Workbench" column. wcn)* In the meantime, I will attempt to give coverage to the indoor scene for *Model Builder.* So, all of you indoor newsletter publishers who have not had my name and address on your mailing list, please add: Bob Stalick, 5066 NW Picadilly Circle, Albany, Oregon 97321. I will try my best to provide some pictures, articles, and news about the activities indoors. If you own a camera and would like to see photos of your work featured here in the column, send them in. A couple of hints: 1. Take action shots if at all possible; 2. Get as close as you can to the subject; and 3. Do not write anything on the pictures . . . use "stickies" attached to the back for your information.

I look forward to hearing from all of you soon.

THE DOMEDUSTER REPLACES THE N.Y. INDOOR TIMES

I just received my first copy of the "Domeduster," an indoor newsletter edited by my old friend and one-time flying buddy, Stan Fink. Stan reports in the first issue that Ed Whitten, long time editor of the "N.Y. Indoor Times," has retired and the "Times" may not be published again. In order to keep information about indoor activities in the Northeast flowing, Stan has begun the new newsletter. If you are interested in news, plans, and other tidbits from the Northeast indoor scene, contact Stan at 1810 Pine St., Philadelphia, Pennsylvania 19103. Subscriptions are $10.00 per year, and if the first issue is any indicator, the price is right!

HAINER'S HORNET FACTORY

Phil Hainer is at it again. Now, Phil is producing replica parts for your Holland Hornet and other Atwood designed small glo engines. These new parts are not handmade, as were the previous offerings, but fully machined. So, if you have an old Hornet that has some parts missing or broken, this might be your chance to get it back into flying shape.

Hornet Needle Valve needles. The first item available is an exact replica of the Hornet needle. This is an exact copy of the original brass needle except the shaft is slightly shorter to minimize breakage. The needle is useable for Wen-Mac, Wasps, Atwoods, and similar engines as well. The price is not set at the time this was written, but the parts and price will be available as you now read about it.

Hornet heads. The next new feature is the Hornet replica glo-head. These are exact replicas of the original, except they are threaded to take a short-reach glow plug. Price is not available at this time, but

again, these heads will be out by the time you read this announcement.

1/2A Glow plugs. If you remember, as I do, the short, short 1/2A glow plugs that were produced during the late 1950s and '60s, then you will be pleased to know that Phil Hainer will be selling replicas of these jewels as well. These will come equipped with a special element and will fit all Atwoods, Wasps, Spitfires, etc. They are specially made to fit the replica Hornet head noted above. These plugs will be available at a date to be announced later.

RATING	COMMON NAME	MANUFACTURER	TYPE
10.0	Plasti-Stic	PIC	CA
7.8	Flex Zap	Pacer	CA
6.2	Thick CA	Satellite City	CA
3.8	Thin CA	Satellite City	CA
2.9	24 Hour Epoxy		Epoxy
2.2	Laminating Resin		Polyester
1.0	5-Minute Epoxy		Epoxy
1.0	Model Cement		Cellulose

Two other Hornet replications are due shortly as well. These are replica Hornet spinners and complete gasket sets for the Hornet and Wasp engines.

Sales will be to dealers as well as direct from Phil Hainer to the purchaser. Phil invites dealer inquiries as well. If you cannot wait for upcoming issues of *Model Builder* for further information and a product review, you may contact Phil directly. Call (206) 854-1791. Phil suggests that you call rather than write, as he is too far behind in his correspondence now. *(I'd suggest he call his business "The Hornet's Nest," and Bob just stirred it up! wcn)*

MODEL RESEARCH LABS UPDATE

Curt Stevens, proprietor of Model Research Labs (MRL), writes to inform of new developments in the carbon fiber field. MRL, in case you aren't aware, is one of the prime sources for free flight carbon fiber applications. Curt notes that some adhesives with which he has experimented perform extremely well and others do not when used to bond carbon fiber sheets. His tests show the following (Refer to Chart):

"With Plasti-Stic, it is important to use some common sense and caution with this glue as it bonds very well to some strange things, like Saran Wrap or plate glass. I recently removed a new wing from my plate glass building surface with a chisel and mallet! This glue sticks to straight pins so well that you often will need pliers to bend the pin over and twist before you can pull it out. There are a lot of us building with this glue, totally.

"About the only thing I have found that it does not stick to is waxed paper, so at least we can go back to covering plans with waxed paper. It is certainly not the right thing to drop on toilet seats.

"Although I may sound like a glue salesman, I'm really not even involved. My only interest is composites, and I can't sell what modelers can't use. All serious, modelers should be using my materials but would you believe that I haven't even heard from some of them yet. We sell more composites than anyone else in the model world, and we still have only about 4200 customers world wide." *(Ahem . . . Curt . . . Have you thought about placing a small ad in a reputable model magazine? wcn)*

Curt notes that he does carry Plasti-Stic, so if you cannot locate any in your area, $4.00 will bring you a one-ounce bottle. Contact MRL at 25108 Marguerite #160, Mission Viejo, California 92692.

NFFS MEMBERSHIPS

Last month, I noted that the membership responsibilities for the National Free Flight Society have shifted from Sal Fruciano to Nat Comfort. Elsewhere in this column this month, you will find a form that you can copy and send to Nat. Don't pass up your chance to become an active member in an increasingly important organization promoting free flight in the U.S. Do it now.

BILL WINTER WRITES

In the January issue of *Model Builder* Free Flight, I featured one of Bill Winter's designs, "The All American," as the Mystery Model. I found a copy of the (incomplete) article in the 1951 Air Trails Model Annual, and found later, that the complete article, including a one page plan, was featured in the June, 1950 *Air Trails* magazine. Bill's letter gives some insights into the model aviation publishing business during his active years.

"Reading your January, 1990 column, I was pleased and very much surprised by your Mystery Model and the account of the 'survey' executed by its designer.

"You will be interested in what I have to add. . . .

"You used the words 'Future Editor . . .' Looking back, I have always felt that no matter what magazines I edited later, or those I was listed with in some capacity, I was already over the hill in 1948-49, which is roughly the time frame of the mystery model: All American.

"I had been hired late in 1936 as Assistant Editor on *Bill Barnes Air Adventurer*, which evolved into *Air Trails* about the time WW II began. I was the editor for some years and had spent 9-1/2 years on that magazine when I undertook more than four years of freelance work . . . during which the All American appeared.

"Over the hill? Well, *Air Trails* was a giant of a magazine . . . the times being ripe . . . which eventually attained almost a quarter million net and approaching 3/4 million gross, with a peak of 231,000. The Air Trails Annuals also sold about 1/4 million copies on the newsstands. And there was Air Progress, an offshoot.

"Most of the truly great models (Korda, Lanzo, Cahill, et al) had been published in the old *Air Trails*. My last issue as Editor was October, 1946. The 'later' you refer to, was MAN in November, 1950. In the interim I played a minor role in *Flying Models* and *Air World*. Incidentally, think in terms of 1940 dollars when you consider A.T.

"Sal Taibi may remember the All American. He told me a Junior beat him for first in Indianapolis, flying one. If there was no drawing or 3-view in the issue you say, it may have been in the following number . . . because the plan was published. An 'A' job with Arden 19, it agreed with Denny Davis' Hogans . . . the average area in the survey was 375 sq. in., and that was what Davis had, so I climbed aboard. The plan is approved for Nostalgia and Bob Larsh used to sell copies . . . probably still does.

"I recall the article mentioned as including pix of a miniature sheet balsa sample of each type I had named. Yeah, Civy Boy could wind down harder and faster than anything in sight . . . you will recall that it balanced at 110 of chord . . . I think. (Actu-

ally, it balanced at 100%, but why trivialize?) Only the B Zeeks with Dooling 29s were wilder when they went wrong . . . but that was, I guess, more a matter of power and size, not that Gilliam (bless his friendly soul) was a piker when it came to power.

"Thanks much . . . I enjoy the column and the magazine. I note all the color and it pleases me that Bill has persevered so long in his policy." Bill Winter.

NOSTALGIA RULES AND ELIGIBILITY LISTS UPDATE

Just after mailing in the March issue of *Model Builder* Free Flight, I received the new official NFFS list for Nostalgia eligible models and the complete rules from Bob Larsh. The new list is much larger and complete; however, I quoted a price of $1.00 per each. Bob notes that the printing and mailing costs have forced the price to $1.75 per each postpaid. Want one? Contact Bob at 45 So. Whitcomb Ave., Indianapolis, Indiana 46241. Ask him if he still has plans to the All American available, as Bill Winter suggests.

THAT'S IT DEPARTMENT

That should wrap it up for still another month. Hope you enjoyed the column, and remember you "insiders," let me know of your activities. You "outsiders" already know what to do . . . catch a good thermal for me one more time. •

Choppers . . *Continued from page 30*

ward flight, and land the Rebel smoothly, you will soon discover by yourself how to come in "hot" and wait for the last moment to punch power and yank the nose up for an impressive quick stop. To make a fixed-pitch helicopter come in fast, instead of reducing the throttle/collective all the way back, you need to push forward on the cyclic stick to dive the model. But take it easy at the beginning.

If you are going to let a veteran R/C helicopter pilot help trim out your new Rebel, you ought to ask him if he has flown fixed-pitch helis before. If he has not, tell him to take it easy at first because he needs to warm up, too! It's like asking a guy who is used to flying airplanes with a two stick-radio to trim out your new model that has a single-stick radio. But since he has developed the feel for heli flight already, he would have no problem hovering it. But, it may still take him two to three flights to get use to it. For a beginner like you, it makes little difference whether it's fixed-pitch, collective-pitch, two sticks, or single-stick . . . just hover it no higher than four inches off the ground for the first few flights. After a gallon or two of fuel, you can probably hover it at eye level.

Once you have mastered hovering and forward flight (about three to six gallons of fuel, it depends on the person), then you can do pirouettes, stall turns, loops and barrel rolls with the Rebel. Pirouettes and stall turns are tres simple with the fixed-pitch Rebel. Loops are easy, too. Just dive the model at a shallow angle to gain forward speed, and simply pull back on the right stick gradually. You need to move the flybar weights in toward the rotor hub to make the model more responsive for aerobatics. Rolls are not as elegant looking as with a fully aerobatic helicopter. Rolling the Rebel is like rolling a Sig Kadet rudder-only high wing trainer plane. You need forward flight speed and move the flybar weights in to do a decent roll.

The strongest point of the Rebel is its relaxed flying style. It just wants to sit there. This gives you plenty of time to think and react. People who know how to fly already will enjoy the non-intense flying style. After flying the fast and aerobatic helicopters all the time, it's very relaxing to take the Rebel out for a spin in the evening. It's like flying an R/C glider, you can chat with your buddies and fly at the same time. Its compact size (40-inch fuselage length, 42-inch rotor diameter) allows you to drop the whole helicopter into the trunk of your car and leave it there. As it's so simple, there isn't much that needs to be maintained. Even though Rebel's overall dimension is small (about the same as the Shuttle or Concept), the canopy is big, the fuselage has a big profile, and the main rotor is taller, so the Rebel is very easy to see from a distance.

In case you crash it, there isn't much that can break. The main frame is 1/8-inch solid aluminum plate. This is not going to bend. What will break is the plastic canopy. The wood servo tray can always be epoxied back together. The tail boom and 8mm main rotor shaft may bend in a hard crash. So, the only spare parts that you need to stock up are the plastic canopy ($17.50), the wood main rotor blades ($14.95), and maybe the main rotor shaft ($9.95).

The many innovative design features of the Rebel include a one-piece molded nylon hingeless rotor head that is supported on two ball bearings. This allows the stabilizer bar (commonly called the flybar) to tilt freely. The tilting action causes both blades to change their angle-of-attack which, in turn, results in the blade flapping up or down. This then causes the rotor disc to tilt. This tilts the rotor thrust vector to move the model helicopter fore/aft, or left/right. This kind of control system is called *Hiller-only*. The paddles at the tip are called Hiller paddles. The weight of the paddles, flybar weight, and the stabilizer bar also help to stabilize the helicopter. (January, 1990 "Chopper Chatter" explained the stabilizer bar theory in detail. In the future, we will explain the differences between Hiller, Bell, and Bell-Hiller control methods.)

As Rebel is designed to be a very stable

trainer, the rotor head flapping is kept very soft. This reduces the control sensitivity, and reduces rotor response to gusts. The other benefit of fixed-pitch helicopters is that they all have 100% Bell-Hiller mixing ratio to act like a semi-autopilot. The main rotor shaft is purposely kept very tall to improve the static stability in hover. Of course, all these traits generate an easy-to-fly machine with a little less aerobatic capability. Well, we think this may be a good way to start. Once you learned to walk, then you learn to run with a powerful machine like the 60-size Schluter Magic, the GMP Legend, or the Kalt Omega.

However, we are not saying the 60-size collective pitch machines are not good trainers. In fact, the 60 Magic, Legend, X-Cell, etc., make superb trainers! The problem with using an excellent 60-size machine is the very high initial expense. These high performance machines retail for around $700, and you definitely need a helicopter radio ($350-$1000), and a good 60-size helicopter engine (average $180). Furthermore, with a high performance helicopter, a beginner definitely needs the help of a heli flier to check over his $1000+ investment thoroughly. Another reason is that high-performance helicopter flier instructions are not usually geared toward the beginners.

Now, let's look at more of the features of the Rebel. The 40-page instruction manual is easy to understand and has drawings on every page. Beginners should be able to follow through. It took me two evenings to construct my Rebel. The total amount of work was 10 hours.

Put together the frames: 2 hours
Install the engine: 1 hour
Assemble the tail rotor system: 1 hour
Assemble the servo tray: 1 hour
Paint the canopy and main blades: 1 hour
Install the rotor head and control linkages: 2 hours
Install the radio: 1 hour
Final checkup: 1 hour

The servo tray and horizontal fin are die-cut plywood. They pop right out. This is great for people who do not have a jigsaw at home, because some kits have plywood trays that require cutting with a jigsaw. The wood tray even has the radio switch hole cut out. The swashplate is metal, and has much less slop than Shuttle's plastic swashplate. The main rotor shaft and tail rotor drive shaft are each supported on two sealed ball bearings. Unlike the Cricket, the Rebel's tail rotor drive shaft is straight and runs smoothly in a brass tube in the center of the tail boom. The brass tube is supported by two foam inserts. This is much better than the Cricket design. I really like it. The main rotor blade is attached to the hingeless head via two factory pre-bent steel straps. Again, these straps are much stronger than the old Cricket straps. If the two blades are out of track during the flight test, you need to twist the straps carefully. Otherwise, you can crunch the blades.

The belt drive transmission is very quiet. Like the Concept 30, Rebel also has a built-in cone start feature for using regular 12-volt R/C airplane starters. The 8-ounce fuel tank lasts about 12 to 15 minutes. It is located on the right side, and close to the center-of-gravity. The fuel level can be easily seen from 10 feet away. The cooling fan works well. Unlike other GMP kits, Rebel's two-piece cooling shrouds are not screwed together. I CA glued the two halves together. An advantage of the side mounted engine is that the conventional airplane muffler which comes with the engine can be used on the Rebel. Almost all the other larger helicopters require that you purchase special helicopter muffler systems. The landing gear has a fairly wide stance, so it should help prevent the beginners from tipping the helicopter over. (First-time chopper fliers should always get a set of training wheels.)

Most metal parts . . . tail boom, frames, landing gear, etc., are all anodized black. I painted the canopy black, too. It looks pretty mean. When the Rebel first came out, the engine mounting plate and main frame were both anodized black which caused radio problems when the engine was running. The solution is to sand away the anodizing where the two parts, the engine plate and the main frame join. This makes the two metal pieces conductors

and solves the problem. New Rebel kits have an addendum sheet explaining this solution to a possible problem.

The plastic ball links in the Rebel are lighter than the stock GMP ball links. Rebel's ball links fit the balls perfectly. Eventually, I suggest that you replace the nylon clevis on the T-shape pitch control arm with a ball link, for less slop. For beginners, the easiest way to cut the canopy is to trim the plastic with scissors, then with a very sharp knife. Even though you may be using an airplane radio, you should invest in an inexpensive gyro. Futaba's 154, GMP's gyro, and Airtronics' SG-X are all retailed at less than $100. With a gyro, four servos, receiver and a 1200 mAH receiver battery pack, the vehicle center-of-gravity will come out perfectly (just slightly forward of the main rotor shaft). Remember, to get four 15-minute flights safely, you must use a 1000 to 1200 mAH receiver battery pack, because the gyro drains extra juice.

For our test Rebel, we used a Magnum 40 ABC that was picked up at Hobby Shack on sale. For the first few flights the idle was rough, but after 10 flights, it smoothed out. As Rebel requires no special helicopter electronic mixing features, a standard 6-channel airplane radio was used. It is an Airtronics Vanguard 6 FM. Four Airtronics 94102 servos were used. The radio has dual rate for all the channels, therefore, setting up the servos for the four controls was a piece of cake. The Vanguard 6 FM has worked very well.

To end this month's column, we show you a letter from Bill Sewell. (If you like to voice your opinions on your favorite model, please send them to me at P.O. Box 692, College Park, Maryland 20740. If you send some sharp color photos, we will show them to the readers, too.) We printed Bill's letter on his Kalt Baron 30 in the December 1989, issue. Here is Bill's comments on the Rebel.

"As far back as I can remember, I always liked helicopters. Around 1967 my dad bought me a model magazine that had a Du-Bro Whirly Bird 505 helicopter. That was a 40-size R/C version of the Cox .049 free flight choppers of today. I spent a lot of time dreaming of flying a model helicopter. Fortunately, by the time I had the financial ability, the Cricket just became available. That was what I learned to fly on. Now, almost a decade later, GMP made an impressive redesign of the Cricket. The new Rebel is just as easy to build as my Cricket. But the new hingeless rotor is easier to set up.

"The things that I personally like on the Rebel include the slide-on style canopy, straight tail drive shaft, rounded and prebent blade straps, and the very thorough instructions.

"My Rebel was flown without a gyro, so some lead was added to the nose to achieve proper vehicle c.g. On the gyro subject, I must say that unless you are the type who tells the dentist, 'No Novacaine for me, doc,' when you have root canal work, then a gyro is the only way to go. I, myself, flew nine years without a gyro. Only this summer I tried one, it spoiled me in a hurry!

"Now, back to the Rebel itself. An inexpensive .46 heli engine was used, and it was installed without any bench test (not the smartest thing that I have done). This made for an unintentional, but interesting test on the rest of the helicopter. The engine had lots of power sags and surges. This lasted for about half a dozen tank fulls. This caused the Rebel to bounce up and down very hard, along with snapping around in yaw between the surges. The landing gear handled all that abuse without problem. The other noteworthy thing is how stable it was as far as the cyclic controls were concerned during all that bouncing around. I did not really do anything on the cyclics to keep the model in one place. It stayed put on its own!

"After the engine broke in, I got the 'feel' of the rest of the machine. The tail is very responsive compared to the Crickets that I have had. I like the feel of the new head design. For Hiller control, it is pretty responsive and tends to 'stay put' better than my fancy collective machine. Flying in fast forward flight made me appreciate the Rebel's larger size. It is easier to handle because it is easier to see the attitude it is in at a distance. Being fixed-pitch, it is still slower to react to the throttle, so the landing approaches were all made with shallow descents. The two things I liked most were the new head design, and the fact it's big and easy to see." •

MD&TS ... *Continued from page 35*

heated argument with his dummy, get disgusted, remove his hand from the dummy and leave the stage, leaving the limp form behind. The dummy would then resurrect itself and continue the argument with much animation, without the aid of its master. Obviously the dummy's voice was then coming from an internal speaker with the microphone off stage at the R/C transmitter. Needless to say it was a startling act.

NONLINEAR CONTROL

If you have a reasonably modern R/C set with lots of bells and whistles, you probably have, and maybe use, something called "exponential." That word comes from the fact that some electronics in the transmitter performs in accordance with a mathematical expression by that name. At the flip of a switch it will give you nonlinear control on one or more channels. "Nonlinear" of course means not straight or nonproportional.

With linear control, a given sized increment of movement of the control stick will always move the control surface the same additional amount, regardless of where in the control surface range the incremental command starts. If our control is nonlinear, the amount of control surface movement we get from a given bit of additional stick movement depends on where the stick and the surface are when we apply the correction.

AILERON "DIFFERENTIAL"

An example of nonlinearity that most of us are familiar with is "differential" aileron control. There we design or adjust the aileron linkage system so that the descending aileron doesn't go as far down as the rising aileron goes up. We do this to reduce the drag on the outer wing so as to reduce or eliminate adverse yaw, and also to reduce the chance of a tip stall in a turn. Actually the word "differential" is a misnomer in this case. All ailerons move differentially, since they move opposite to each other. What we really mean is that the control of the up aileron and the down aileron are nonlinear with respect to each other. We will talk about aileron differential some other time.

On elevator, however, we have a different reason for wanting nonlinear control. If you fly a hot ship with considerable speed range you have noticed that you need lots of elevator deflection for aerobatics and for landing, but at full speed it is a bit difficult to give small enough stick movements for smooth flight. In other words, with linear control, if we adjust for the big throws we need for aerobatics, the controls get more sensitive than we would like near neutral. Nonlinear control to the rescue. What we would like, and can have with exponential, is reduced servo sensitivity close to neutral without reducing maximum throws.

Sophisticated modern R/C transmitters often have "dual rate" switches alone or in conjunction with exponential. With dual rate, the pilot can fly with the control surfaces operating at low rate or modest throws, and with the flip of switches on the transmitter, convert to large throws for spe-

cial maneuvers. In a way, this is like the nonlinearity provided by exponential, except that the pilot must remember to hit a switch whenever she (unbiased column) wants more or less throw on a particular control.

A poll of top competition pattern fliers shows some use dual rates, some use exponential, and some use both. I personally prefer exponential only, since with my occasional flying it's all I can do to remember which thumb does what, let alone to remember and worry about which additional switch to flip and to try to find it without losing the airplane.

On ailerons we can actually have two types of nonlinearity simultaneously. As mentioned, we can use aileron differential, a type of nonlinear control, and we can use exponential on the ailerons. Then not only will we get more up than down aileron, but we will also have plenty of aileron throw for a fast roll rate and yet have "slow" or precise roll control in level flight where the required aileron deflections are very low.

NONLINEAR LINKAGES

We get the nonlinearity on ailerons that we call differential by the way we set up the hardware, not by electronics. Perhaps you haven't thought about it, but we also have all kinds of hardware-induced nonlinearity in our other controls, whether we like it or not. Unfortunately, as we shall see, these nonlinearities are frequently in the wrong direction.

Any time we have a rotational arm (a servo arm or a control-surface horn) driving or being driven by a push rod, the response is nonlinear. That is, one degree of rotation of the arm will produce differing amounts of rod travel, depending on the current angle of the arm with respect to the rod. Here the nonlinearity is trigonometric (sine function) instead of exponential, but that is academic at this point.

Please study Figure 1a. Note that when the rod and the arm are at right angles to each other the arm length is fully effective, since the rod is at its maximum distance from the servo shaft. In this position the rod movement is maximum for a given arm movement. However, when the arm has swung to an acute angle to the rod the rod is closer to the servo shaft. The effective arm length is now less than the actual arm length, therefore the rod movement is less for a given arm movement.

If the push rod is connected to a servo arm and a control horn of the same length (seldom the case), and if the arm and the horn are parallel to each other, one can see in Fig. 1b that we again have a linear system. The arm and the horn always stay parallel. The travel of the rod is nonlinear with respect to the servo arm and also with respect to the horn, but these nonlinearities are equal and opposite and cancel out.

The nonlinearity at the control-surface end of a push rod is in the favorable direction. That is, it gives us more precise control near neutral, similar to the effect of exponential. It is the servo end that may make our control in level flight more sensitive than we would like. Unfortunately, the bad nonlinearity at the servo end is usually greater than the good nonlinearity at the control horn, since the total angle of rotation of the servo arm is usually greater than the maximum desired rotation of the control surface. All of this is illustrated in Fig. 1c.

Back in the 1950s and 60s some or most R/C servos had linear outputs. That is, the tab we connected the push rod to moved in a straight line because it was attached to a rack (a straight-line gear) which was driven by a pinion as shown in Fig. 1d. These relics were larger and heavier, more expensive to make, had more friction, and were very poorly sealed against water and fuel, but they were linear. The R/C manufacturers soon wisely realized that the linearity wasn't worth all of those disadvantages, and the rotary-type servo became standard. (Futaba still markets one linear or rack-type servo, their #FP-S11.)

On a non-aerobatic plane where we need only up elevator, we can easily adjust the elevator linkage for favorable nonlinearity. This is illustrated in Fig. 1e. Note that we used a longer than usual servo arm but mounted it at an angle so that the pushrod travel per increment of servo rotation increases with the amount of deflection.

But those of us who like aerobatics also need lots of down elevator. Further, this arrangement would never work for rudder, which definitely needs to deflect in both directions. So if we want favorably-nonlinear systems we usually need ex-

ponential, or we need to become creative. I have a transmitter without exponential that I still like to use for another reason, so I got creative.

THE BIRTH OF AN INVENTION

It began to occur to me recently that the good-only-one-way nonlinear linkage of Fig. 1e could be converted to a good-both-ways nonlinear linkage. If an angled arm gives desirable nonlinearity in one direction, then I should be able to use two oppositely-angled arms, one for each direction, and switch the pushrod from one arm to the other at the neutral position. After some design configuration effort, the relatively-simple linkage of Figure 2 evolved, where the original part of it is the slotted dual-servo-arm device.

At the neutral position, the push rod engages both arms, but with servo rotation in either direction one or the other slotted arm disengages from the rod. A light spring at right angles to the rod is required to insure that both arms don't disengage at the same time.

As can be seen in the photo, the two "arms" are simply two holes drilled in a large-size plastic servo disk such as many servo manufacturers provide. The slots are then sawed and filed to the holes. A jeweler's saw and pattern-maker's files are best for these operations.

Two coupling pins are required on the rod, one to couple to each "arm." I found that the easiest way to provide these pins was to add a second zee bend to the 1/16th wire rod end, as shown. The distance between the two resulting pins must be exactly the same as the distance between the open-sided holes at the bottom of the slots on the two arms. It is not easy to bend wire to such precise dimensions. I therefore make the distance between the pins slightly too great and then adjust it by bending the wire section between the pins a little as required.

As I laid mine out, the effective servo arm length approximately doubles in going from neutral to either extreme, therefore the control is only about half as sensitive at neutral as it is at full throw. The amount of nonlinearity is the designer's choice, however.

By drilling the "arm" holes at different radii on the disk, the device could be made to have more nonlinearity in one direction than the other as shown in Fig. 3.

By way of comparison, note that the basic favorably-nonlinear linkage is very similar to a rack-output linear servo, but with only two teeth in the rack (the two pins). Since the rod is closer to the servo shaft in the neutral position (because there are no intermediate rack teeth), the new device is not linear like the rack servo; it is nonlinear like exponential.

As a mechanical engineer, I will admit that exponential may be more reliable than my mechanical gadget. Exponential is also simpler for the average R/C modeler, since it is something he can buy instead of make. Further, the amount of nonlinearity is readily adjustable when we use exponential, but the only way to change the amount of nonlinearity with the double-arm device is to make a new one.

Beware! This non-linear linkage as sketched above, tends to come apart under load. Experiment, but don't fly it. I have since solved the problem and will present the modified safe version in MD&TS as soon as possible.

PARTING WORDS

A fellow was asked, "Which is worse, ignorance or apathy?" He replied, "I don't know and I don't care."

Francis Reynolds (AMA #9241), 3060 W. Lake Sammamish Parkway N., Redmond, Washington 98052. SASE please. (206) 885-2647. •

Plug Sparks *Continued from page 46*

is not immune to the Playboy disease as he has ten in his stable, built over a 15-year period. However, what most of the modelers miss is the point that this writer has built a tremendous variety of models, to name a few: Shereshaw Champion, LaTorre Raider, Dallaire Sportster (4), double size Hopalong, 10 ft. Clipper, first R/C Lanzo Stick, Scram, Powerhouse, Mike, Flamingo, Gulliver, Triangle . . . oh, I could mention at least six more. The point is that the old-timer game offers the opportunity to build so many different types for one's enjoyment. This business of having to have a

guaranteed winner gets tiresome.

Point in case is a letter received from Jim Horner, of 15746 Walkwood Drive, Houston, Texas, who writes as follows:

"We just received our SAM Speaks a few days ago, and we are mighty proud of the showings of our representatives from Texas based on the SAM Champs results at Jean, Nevada.

"Overshadowing those fine results was the realization if you don't fly a Lanzo Bomber, you might as well stay home. This model is a fine design, but it is so overdone that we could almost dispense with the flight times and conduct an engine test on the ground to determine the winner. Of course, I am being facetious but this is a problem of major proportions. The situation takes the fun out of flying anything else knowing you are going to be skunked by a Lanzo Bomber(s) every time.

"We need more flyers with the skill and imagination of Eut Tileston. It is my opinion we should have an award(s) for the most innovative and successful competitor. A moot point to be sure, but perhaps a vote by the participants would suffice?"

This writer says, "You said it, buddy. I'm with you. I am open to ideas."

If the reader doesn't know what we are talking about, Photo No. 7 is shown of Bob Bennethom who won the best monokote finish on a Lanzo Bomber.

SO. CALIFORNIA FREE FLIGHT ECHOS

R.J. Mikkelson (Mik) who this writer sometimes refers to as "Jasper" has been a busy photographer as usual. This writer considers himself lucky that Mik has seen fit to send in occasional photos of the free flight action in Southern California.

Photo No. 8 is a shot of a rarely seen English design called the "Comet II" designed by A.E. Brooke and featured in a 1938 *Aeromodeller* issue. This six-foot model, built by Brad Levine, powered by a Vivell 35, was seen at the SCIF Texaco meet in September 1989 at Taft (where else?).

Prior to that at the SCAMPS Fun-Fli at Mile Square, Mikkelson caught our *MB* Editor in Photo No. 9 with a "bones" Korda Wakefield (will wonders never cease!). Since then, the model has been covered with red Japanese tissue. Good to see our "boy" tries them all!

SAM 1

One of the great things about the SAM Champs is meeting many of the modelers you have corresponded with over the years and never have had the opportunity to make their acquaintance.

Such was the case of Art Groshneider, of 2045 So. St. Paul, Denver, Colorado 80210 who is the editor of the SAM 1 newsletter. As previously reported, Art produced a video of the action at the Jean, Nevada SAM Champs. This has been well-received by all SAM Chapters.

In his letter, Art sent in several photos of his latest endeavors. We have selected Photo No. 10 showing his Fox 50-powered Powerhouse. "The initial setup was to have interchangeable engines for different classes. However, the Fox 50 turned out to be such a gem of an engine so decided to go with it.

"The model was launched on its maiden flight only to discover very poor response to the controls. Luckily, the engine was set too lean and quit. The model bounced in without too much damage.

"During the repairs, I discovered that I had never unwrapped the antenna in the new receiver. Once strung out, the model flew fine. At Jean, Nevada, I kidded Sal Taibi about what a dud the Powerhouse was under intermittent radio control." (Ed. Note: some guys have all the luck!).

LOS ANGELES, THE GOOD OLD DAYS

Old-Timer Carl Stokes Jr., of 14702 8th Ave. N.E., Seattle, Washington 98155, sends in four photos of the old days of the control line craze (1945-50). Unfortunately, most of the four are taken too far away to reproduce well.

We have selected Photo No. 11 showing a pair of famous modelers, Frank Greene of Falcon Models Co., and Lew Mahieu,

well known for the Zeek designs and Supersonic products. This shot (slightly clouded) was taken at Compton High School during lunch time in the Spring of 1947.

The L.A.A.M. Club was probably the biggest and most powerful in those days. As a matter of fact, they almost bought the Western Rosecrans flying field. Some of the outstanding members were Ray Acord, Bill Butler, Dan Lutz, and Bill Laine to mention a few.

As Carl says, it's too bad we don't have people with that kind of power to help rekindle the free flight fires today! Just think if they had bought that flying field!

READERS WRITE

Received a most interesting letter from Edmond Bond, 418 Virginia Ave, Tracy, Ohio 45373 who sent in Photo No. 12 of his "Lancer" powered by an O.S. 40.

This 72-inch model was originally designed with an inverted engine but as one can see, Ed mounted the powerplant upright for easier starting. This is a common mistake most modelers make with four cycle engines fearing "hydraulic lock" with too much fuel. Question: how can one lock up the piston when the valves are spring loaded? They will pop open under pressure. Found this out in my Sopwith Camel with inverted 60 4/c OS engine. This statement should lead to some controversy.

Ed has also scaled the 72-inch model to 102 inch wingspan. This flew great for six flights until a radio failure. Oh well, he still has the wing!

A few other points are the cowl is made of light rolled plywood, covering is "Solar Tex" and wheels are the Williams Bros. balloon type. Look quite good and realistic for old-timers.

EAST COAST O/T CHAMPS

Received a most interesting letter from Jim Coffin, 4604 Hillbrook Drive, Annandale, Virginia 22003, wherein he submits Photo No. 13 of his Advanced Challenger, a John Drobshoff design.

This pic, taken at the SAM 7 East Coast SAM Champs on the Labor Day weekend at Westover AFB, Springfield, Massachusetts, shows Coffin' Challenger powered by an OS 15 converted to ignition. The photographer must have put the "whammy" on the model as this was the last flight; the wing folding at the bottom of a wind-induced loop.

Jim feels the model had a crashed spar that occurred at Lawrenceville NFFS Champs in June so does not blame the structural design.

AUSTRALIA

Joe McGuffin, Secretary-Treasurer of the Australian SAM Group (#1788), sent in a series of photos taken at the State Radio Control Association (RCAS). This meet was held at the Race Course Track area where the 1988 Australian Richmond SAM Champs were held in conjunction with the Australian 50th Aviation Anniversary.

Seen in Photo No. 14 is John Chadd, president of the State Radio Control Assn., with Joe McGuffin's Finneran Flyer utilizing an Enya 46 for power. This design was the first successful Australian Gas Model design by Jack Finneran back in 1935/36. Those wishing details can write to Joe McGuffin, P.O. Box 286, Engadive, NSW 2233, Australia.

In a letter from Bruce Abell, 17 Ferguson St., Cessnock, N.S.W 2325, Bruce, the glider column editor for *Airborne,* reports that he has uncovered a supply source of castings and plans for old engines, mostly Edgar T. Westburry designs.

These have been identified as the 5cc "Kestrel," 10cc "Craftsman Twin," 15cc "Kiwi" and 30cc "Kittyhawk." Bruce is quite enthusiastic over this find of drawings and castings.

To this end, Abell has sent the photocopy of the engine brochure and side views to Peter Chinn in the hopes that Pete may be able to identify the date of these motors. We are pretty sure they are 1942-46 designs, but will give the correct dates as soon as substantiated.

In that line, Abell has just finished a "Matador" four cycle .60 from plans published in the English magazine, *RCM&E.* This engine is shown in Photo No. 15 mounted in a Lackey Zenith. The engine is machined from solid stock (no castings) with the bevel gears, spark plug, and sundry screws being the only commercially obtained parts.

Manufacture of the engine was quite frustrating at times but was a very rewarding experience. The engine turns a 13x6 propeller at 7,000 rpm making the Lackey Zenith a very suitable mount. Of course, the model is covered with polyester chiffon, doped, with red and blue pinstripe.

MORE "OZ" CORRESPONDENCE

Keith Murray of Belrose, NSW, Australia, writes to report on this writer's "Pomona Champ" that was left at the MAAA Nationals at Wakerie, So. Australia. This model which showed excellent promise in test flights promptly broke a motor with only 200 turns. Curse that Filati rubber!

The model was repaired in time for the auction put on by MAAA to benefit the local city's hospital. This function raises quite a bit of money which is the modeler's way of saying thanks to the city for their hospitality and cooperation.

Keith bought the model and in turn, told Pond he would enter the model as a team entry. We were supposed to fly the model at the Brisbane MAAA Nats at Amberly AFB in January 1989. Again signals got crossed and the model was not flown.

However, in the hands of expert FAI flyer, Jon Fletcher, as seen in Photo No. 16, the model lived up to its promise. Two easy max flights were obtained. On the third flight, the rubber bunched up badly as can be seen by the damaged fuselage. However, the model still garnered enough time to win easily.

In correspondence with Keith & Jon, this model will be saved for the MAAA Nats in 1990/91 at Bendigo, Victoria, where this writer hopes to go to Australia for an unprecedented seventh time! The writer has an Honorary MAAA membership. Now we only need a citizenship passport!

GOOD NEWS!

Francis J. Tlush, 2114 S.E. 24th St., Cape Coral, Florida 33550, writes to report the missing "one-of-a-kind" Tlush Super Ace (B-1) that disappeared March, 1983, has made a miraculous appearance in April, 1989. "Believe it or not, it came to our door in February, neatly packaged with no return address." Francis is greatly pleased and asks no questions! •

ARFs ..... *Continued from page 41*

Ugly Sticks to a flat-out fun fly design. There were two Royal Telstar 40s, a Great Planes O.S. Ryan, and a Cherokee from Sunshine Hobbies, these four airplanes comprising the rest of the ARFs in the contest. For those of my readers who doubt that an ARF can compete with a standard built-up model, let me point out that the

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MAKE A BEERCAN BIPLANE, 9 inches long, with 14 inch wingspan. Instructions, photographs, patterns. $10.95 plus $1.00 postage. Kit Nine, Box 72104, Marietta, Georgia 30007.

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SCALE RUBBER PLANS. Over 50 Collector's quality plans. Scale 3/4" to foot. Spans to 34". 1915's to 1940's Golden Age, American Military, British, French, German, Japanese. $6.00 each PPD. SASE for list. Flying Scale Inc., 1905 Colony Rd., Metairie, LA 70003.

1930s MODEL SHOP! Sawed prop blanks, WWI/Balloon/Streamline balsa wheels, Hinoki wood, color nitrate, sticks, tissue, bobbins, prop hinges, bamboo, old Scale/Contest plans, and more! Illustrated mail order catalog: $2. Oldtimer Model Supply, P.O. Box 7334, Van Nuys, California 91409.

WANTED: Pre-1950 model airplane engines and model race cars. James Clem, Box 524 Sand Springs, Oklahoma, 74063 (918) 245-3649.

"EASE-OF-FLYING RATINGS OF R/C TRAINERS." $1.95 plus 45¢ postage. Jim Waterman, 3818 Deerfield, San Antonio, TX 78218.

CARBON FIBER: sheets, rods, tow, mat, tailboom. Other Free Flight supplies. Send SASE to Bradley Model Products, 1337 Pine Sap Ct., Orlando, FL 32825.

ANTIQUE MODEL IGNITION PARTS CATALOG, 1990, Timers, Tanks, Needle Valves, Cylinders, Points, Pistons, Drive Washers, Plugs, Operating Instructions, Engine Kits Engines, Atwoods, Cyclones, Delong, Others. 1,000 Parts, $8.00 PP., Foreign $16.00. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, New York, 12078.

Randolph Dope, Butyrate, Nitrate. Clear, colors thinners. New sport/stunt Control-Line kits, .19 to .50 engine sizes. Send $1.00 for information pack to: ABC Hobby Supplies, P.O. Box 2391, Clarksville, IN 47131.

SCALE DOCUMENTATION. PLAN ENLARGING. Photopacks, three-views, drawings for 1800 aircraft. Super Scale R/C plans for Giant, Sport. 82 page catalog $4.00. Scale Plans and Photo Service, 3209 Madison Avenue, Greensboro, North Carolina 27403. (919)292-5239.

ENGINES: Four page list of IGNITION/GLOW/DIESEL ENGINES, also KITS/PLANS and HOBBY ITEMS. Thinning out my collection because of moving. Send $2.00 plus SASE to LARRY VANCE, 5046 SCHUMANN DR., LAS VEGAS, NEVADA 89102.

GRUMMAN F4F WILDCAT KIT #11, 1/24 scale, rubber powered. Complete kit with decals, canopy, documentation, hardware, instructions, etc. First of a series from Flying Scale Models of WWII. Price $19.00 plus $2.50 shipping. Catalog $1.50. Diels Engineering, Inc., Box 101, Woodville, Ohio 43469.

Closing out M.A.P. (Aero modeler) plans. Send legal size self-addressed stamped envelope for listing. First come, best selection. Hobby Hideaway R&D, R.R. #2, Box 19, Delavan, IL 61734.

FREE RC CAR PARTS CATALOG. One of the largest selections. 1-800-HOBBY-98. Hobby Stop, 10002 Aurora N., Seattle, WA 98133.

GARAGE SALE: I have too many kits, etc. Send for list of kits (mostly Ben Buckle Old Timers). Some electric motors. Bill J. Polk, 9413 Freedom Way N.E., Albuquerque, New Mexico 87122.

10,000 FEET IN 10 SECONDS Advance Model Rocket kits. Rockets up to 4" in diameter, 8' tall, and 1000lb of thrust. Catalog $2.00. THOY Dept. 390M, P.O. Box 467, Ypsilanti, MI 48197.

"BEAN ROCKS" by WILLAIRCO, $6.75 per dozen. Beginners, roll-your-own, duration rockets for jet models and matching kits (U-2, F86K, F84, etc.). Send two stamps to WILLAIRCO, 2711 Piedmont Rd., N.E., Atlanta, GA 30305.

ENGINES: IGNITION, GLOW. New, used. Sell, trade, buy. SASE for list. R. Eierman, 504 Las Posas, Ridgecrest, California 93555, (619) 375-5537.

RUBBER POWER KITS AND SUPPLIES our specialty, also FF Gas and Electric. Send $2 to Airmen's Supply Co., P.O. Box 1953, Norfolk, Nebraska 68702-1593.

Starhawks cleaned up with first, second, and fourth places, even though they made up only one-third of the entries! That certainly says a heck of a lot for ARFs in general and Starhawks in particular.

To really spice up the fun fly, Thorpe Engineering gathered together some of the loveliest young ladies that could be found to compete in a contest to choose "Miss Starhawk of 1990." Yours truly was one of the judges, and the winner was Ms. Samantha Emma of Tempe, Arizona. She will represent Thorpe Engineering in future advertisements and at various trade shows. It was a difficult choice, as all the contestants were truly beautiful.

Doug Thorpe intends to make this contest an annual event, and promises to put out the word early enough so that we can give ample notice in this column. So remember, all you fun fly enthusiasts have a date next winter in Mesa, Arizona. Details to come later, so keep a watchful eye on future issues of *Model Builder*, your favorite model magazine.

EXETER HOBBIES, AN EXERCISE IN EXCELLENCE

While covering the Starhawk Fun Fly it was my good fortune to meet Roger Hightower, proprietor of Exeter Hobbies, and co-sponsor of the contest. Roger operates a full service hobby shop at 2111 Alma School Road, Mesa, Arizona, and I mean full service! First of all, he deals in virtually every facet of modeling; airplanes, boats, and cars, with special emphasis on radio control. He just can't abide folks coming in and looking confused, so when he spots a potential customer who is an obvious beginner, he makes a point of extending a warm and friendly greeting, accompanied by a genuine offer of advice and assistance. "So, what's unusual about that?" you may ask. True, many hobby shops offer the tyro all kinds of help. However, Roger goes just one step further by maintaining a fully equipped and spotless workshop for the use of his patrons at absolutely no charge! Naturally, the workshop is available to anyone who purchases a kit from Exeter Hobbies, but Roger usually won't turn away a modeler with a project obtained elsewhere. This spacious working facility is

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provided by Roger at a considerable expenditure of both time and money, and I for one, commend him for his efforts to further the education of aspiring model builders. Let us hope the hobbyists in the Mesa area continue their appreciation and support of Roger Hightower and Exeter Hobbies.

MORE ON THE HISTORY OF ARFs

Almost-ready-to-fly and ready-to-fly airplanes go back a long way, probably to the early part of this century, and in past columns we have mentioned a bit of ARF history from time to time. For instance, we touched on the Lanier line of R/C airplanes which must by now be approaching its thirtieth anniversary. And what old time modeler can ever forget the line of ready-to-fly balsa ukies complete with 1/2A engines, manufactured by that genius of aeromodeling, Jim Walker? And what about all those balsa R.O.G. jobs, complete with rubber bands and propeller? These must be the most popular powered models ever made, as they are still available today in very much the same form. The earliest ARF I know of is the penny glider, which now sells for about a buck or so. I vividly remember losing a few of them to thermals in my younger days, well before I ever understood what a thermal really was.

And no discussion of the history of ARFs could even approach completeness without mentioning the fantastic series of COX plastic U-Control models. These have been with us since shortly after World War II, and have served to train many thousands of active modelers. Nor has Cox been content to sit back and rest on its laurels, as not a year goes by without their introducing a plethora of new and innovative products to their enthusiastic consumer market. So popular are their products that a whole fraternity of model collectors specializes in the collecting of Cox plastic ukies, and some of the older ones command really fancy prices these days.

What has been thus far discussed is primarily to serve as a reminder to our readers that when we run across a piece of model history we should do all in our power to preserve and to document our find. Therefore, in keeping with that premise, I would like to tell you about a truly fascinating ARF I recently encountered.

This airplane dates from 1947, and the reason we can be so certain of the date is that we have a copy of the original advertisement that ran at that time. The model, called the 'P-51 FLY-A-WAY,' was made of .010 Alclad aluminum, with a wing span of 27 inches and an overall length of 21 inches. It came complete with an ignition engine, and was rigged, of course, for U- Control. It resides in the collection of Joe Shaffer, of Ridgecrest, California, and here's what Joe has to say about this rare and beautiful little jewel:

"As the enclosed copy of the original brochure indicates, this early ignition ARF was made by 'Miniature Motors, Inc.' It is my understanding that this was one of Bill Atwood's many companies. The example I have of this model airplane is in flyable condition, although I have never attempted to do so. The 'Bullet 100' motor that is in the model runs good and starts easily, as do all such Bullet engines with which I am familiar.

"The outboard wing of this model has suffered some damage and although I have repaired it I would still like to upgrade it further. If any of your readers have one of these models that they would part with I would like to have another to combine with this one. Even parts would be welcome, as I might be able to make a trade with someone for those parts that I need."

So there you have a highly interesting insight into one of the most unique ARFs ever offered to modelers. If any of our readers can help Joe in his quest for another P-51 FLY-A-WAY model, let me know, and I'll see that you get in touch with him. And if you think you have any other contributions to the history of ARFs, please let us all in on it. I promise to see that you get full credit for your valued input to this column.

It's time to let the word processor cool down while we gather some hot new material for next month's column. Meanwhile, direct your correspondence to me at 2267 Alta Vista Drive, Vista, California 92084 (SASE for reply, please), or call me at (619) 726-6636. Don't forget, you can also FAX me at (619) 726-6907. May your days be filled with a lot more flying and a lot less building! •

Indoor..... *Continued from page 51*

several sessions ago in Burbank, for your writer. I was retrimming my 14 BIZ Peanut and noticed it refused to climb on the same trim I had previously used. Then I figured out that the patches used on the inboard wing had increased the weight just enough to tighten the turn. A small amount of modeling clay on the outboard wing tip made a world of difference. The next flight put the 14 BIZ up to the ceiling. My stop watch read 64 seconds when the

craft touched down.

I need to know what you are building and flying out there. Also needed are photos of you, your models, and your club activities. Send them to Ken Johnson, 16728 Bermuda Street, Granada Hills, California 91344.

See you next time. •

Midair. . . . . . *Continued from page 31*

book," or "The Linear IC Cookbook." Though not dealing directly with this problem, this publication includes a wealth of extremely well written data about LASERs and their applications, removing much of the mystery about this device which up to now has been out of reach for the average experimenter. The spark of an idea was born.

The other important breakthrough came about as a result of progress . . . which made obsolete a very small LASER device which turned out to be the heart of our '90s Mid-air Collision Avoidance System. I call it the '90s system because such a system could not have been available to us earlier, we are indeed lucky circumstances worked for us now as they have. The device in question is the Phillips N515-COLA gallium arsenide infrared Class 3B LASER diode and collimator; completely self-contained in a metal case only 7/16" diameter and 1-1/4" long. The N515 operates in the easily controlled and processed 806 to 820 nM wavelength, with an output of 2.5mW at 85 mAH, even including an internal photodiode for reference and control. The unit was originally intended for gunsights and communications, and though of relatively low power in the LASER family, it is ideal for our application as power translates into range, and we are using it at extremely close ranges. Also, the low power output means low power requirements . . . small, light batteries!

Before we go any further with an explanation of some of the terminology we have just dropped on you, such as LASER, collimator, etc., let me ask that you forget your initial Star War reactions that the word LASER brings to mind. The system to be described is NOT going to shoot out a purple beam to disintegrate any unsuspecting model that wanders across your flight path. I will admit though that the thought has crossed my mind that with a ROM (Read Only Memory) microprocessor on board and a little more power, the LASER could be programmed to recognize and zap all Ugly Stiks and similar flying things! LASER technology has come a long way, and while some probably exist that could easily do that, they have also been developed to do such mundane things as removing warts and trimming ingrown toenails. Ours is a tame sort of LASER, which, when properly installed and adjusted, will cause your airplane to take immediate evasive action any time anything solid is within fifty feet of its flight path. This distance has been arrived at after much inflight testing with captive metallic balloons, a really fun part of the project.

But I digress . . . on to some explanations. First, the LASER itself, is an acronym for Light Amplification by Stimulated Emission of Radiation. The design and construction of a LASER involves atomic physics and chemistry, which I will leave to the experts. Application of the LASER involves something a little easier for me to grasp . . . optics, which is where the collimator comes in. The collimator is a device used to control light, to transmit its rays in parallel, as opposed to the most common diverging rays. Having all of this done for us in a small brass tube is the only thing that makes our collision avoidance device possible. In fact, it's a piece of cake!

In use, the LASER and associated equipment is mounted in the right wing of the model, aimed ahead and slightly left. The LASER transmits short pulses of modulated invisible infrared light, and initially our experiments were all with the amplitude of the light reflected from the target. The idea at the time was that we could measure the intensity of the return, translating it to distance. We discovered almost immediately that the return varied greatly, being affected by the material of which the target was composed, and calibrating the receiving equipment was too critical for the casual user. The next scheme, which worked well in all respects and which we adopted was the simple billiard ball theory . . . any return will be at the same angle as the outgoing beam. Thus we separated the LASER transmitter and receiver, mounting the latter in the left wing. With a simple adjustment of the angles, we can then establish how far ahead the target has to be to get the return directly back into the receiver. Alignment is easy; the equipment includes a test point to which a simple voltmeter is attached which will indicate a peak reading when the two are in line.

So far so good. We have transmitted an infrared pulse, and if it has encountered a target, received a return back. The rest is simple adaptation of already existing R/C technology, borrowed in fact from the R/C helicopter gyros. The electronics package is equipped with regular servo wiring to match your R/C unit; connections are made to the receiver's aileron and elevator servo outputs, with the respective servos then being plugged into matching output connectors. Everything operates normally, with all transmitter functions being usable. However, when a target is signalled, the processed infrared return is fed to a comparator which overrides the servo input from the receiver and drives the servos to a new position. You can adjust both the direction and throw of the servo movement; we believe that a sharp left and down is best. Left because you will get some help from engine torque, down because the airplane is naturally more responsive to that than it is to an up control. Your model is now out of harm's way, the LASER system is no longer getting a return, and reverts to normal. Neat, huh?

But wait, scoff the unbelieving! What happens when you start to land, and the LASER system picks up the world? Does the system then become an automatic re-kit'er? No, and this is where our early experiments with the sensitivity of the return paid off. The difference in the amplitude of the return from even a quarter-scale model, and solid earth, is so great that it is

easily distinguishable at the comparator, and in the latter case the sensitivity is adjusted to simply bypass it. Neat, huh?

The LASER R/C Model Collision Avoidance System is an added expense, yes. But how much does your large scale airplane represent in time and money? Actually, the system is not expensive; and in an effort to keep cost down and promote flightline safety, the manufacturer is making it available in a semi-kit form for the experienced electronics hobbyist. The kit includes the printed circuit boards, LASER and infrared receiving pickup and interface with mounts, and all the critical ICs and components. Not included are the basic, easily obtainable components, such as resistors and capacitors. Naturally, complete construction, installation and adjusting instructions are included. Less batteries, the entire system weighs between five and six ounces, depending on the size of the model and the required wiring. With field charging, the smallest NiCds can be used for power, thus keeping the total well in range of even medium sized airplanes.

Where? When? At present, there is a waiting list, so don't procrastinate, contact the manufacturer: FOUR-ONE ENTERPRISES (see advertiser index) for an information packet, which includes current pricing and availability information. Be the first at your flying field to be an authentic FOUR-ONE'r! •

Yoshioka . . *Continued from page 33*

was found unacceptable for the nose area, so a second material was used. The joint between the two is very visible. This white plastic nose section is fastened by four black screws which further accentuate the differences in the two materials.

All things considered, my objections are minor. In the aesthetics department, I rate the ONAIR 1700E a very high 4.5.

Aerodynamically: The ONAIR features the popular Wil Schuemann-inspired wing planform of multiple sweeps in the leading edge and a straight trailing edge. This shape is said to lower drag at low speed by preventing boundary layer separation at the trailing edge of the tip from traveling across the entire wing causing extreme profile drag and loss of lift (a full span stall).

Furthermore, the multiple tapers in the wing closely simulate the optimum elliptical wing shape for elliptical lift distribution. This is important for drag reduction at high lift coefficients where induced drag is high. Also helping to cut induced drag are the curved, seamless, swept wing tips which are molded as part of the wing. This is one case where form follows function beautifully. This is all very good.

The ONAIR's fuselage is oval in cross section and very slender for an electric. The spinner fairs very well into the fuselage as does the canopy. This shape helps cut parasitic drag. NASA intake duct air scoops also help reduce drag while maintaining efficiency. The fuselage-to-vertical fin junction as well as the fuselage-to-main wing junction show smooth fairing and flowing lines, further drag reduction. No deductions from perfect so far.

The airfoil used is not specified by Yoshioka, but it looks similar to an Eppler 193 at the root, transitioning to a what looks like a thinned E193 or E205 at the tip. In flight, the overall cleanness of the design and the airfoils chosen yield a very fast climb, fast glide, fairly broad speed range, good thermaling efficiency, and only one very minor flaw . . . mild tip stall at slow speed in tight turns *(Refer to Bill's "R/C Soaring" column this month, regarding Schuemann-style wing "tip stall." wcn).* Overall, very good, but subtract a fraction for the tip stalls.

Stock from the box, the ONAIR 1700E comes with a 7x4.5 prop. As an option, you can get a Yoshioka 7x5.5 prop for steeper climb, but reduced run time. As tested, our ONAIR reached about 300 feet in the first minute of run time on a brand new, never cycled, peak charged, seven cell 900 mAH battery with the stock prop. On its second flight, the optional 7x5.5 prop was used. The ONAIR now reached about 400 feet in the first minute. Two flights later, this rate held true. With time, this excellent climb rate will improve as the brushes break in making better contact with the commutator. Three to four climbs to thermal altitude are possible from the 900 pack.

A Panda PSC-1 (75 amp) MOSFET speed control was used during the testing. It worked perfectly and never went above a warm operating temperature in spite of the limited air flow through the fuselage and lack of heat sink. I recommend using an electronic speed control, and for the money, a Panda's hard to beat.

Aerodynamically, considering the ONAIR's careful design and remarkable performance, I will have to rate it an excellent 4.7.

Structurally, the ONAIR might have some weaknesses. The ONAIR is 95% made of white polystyrene expanded bead foam core with white plastic skin and strategically placed plywood reinforcements. The parts are obviously molded.

Initial testing has proved that the surface of this material is prone to dents and scratches. To prolong the life of the model, I would recommend flying it from a mowed grass field whenever possible.

The wings are likewise foam core, but with hollowed out sections behind the high point of the airfoil. There does not appear to be any spar. However, the wings do seem strong enough for careful aerobatics. The wings flex a lot, but so far they've held.

The tail skid of the ONAIR 1700E is made of this skinned foam material, and it was first to show signs of wear. It was compressed badly and was slightly ripped open on its first landing. However, there were extenuating circumstances, and this is probably not typical.

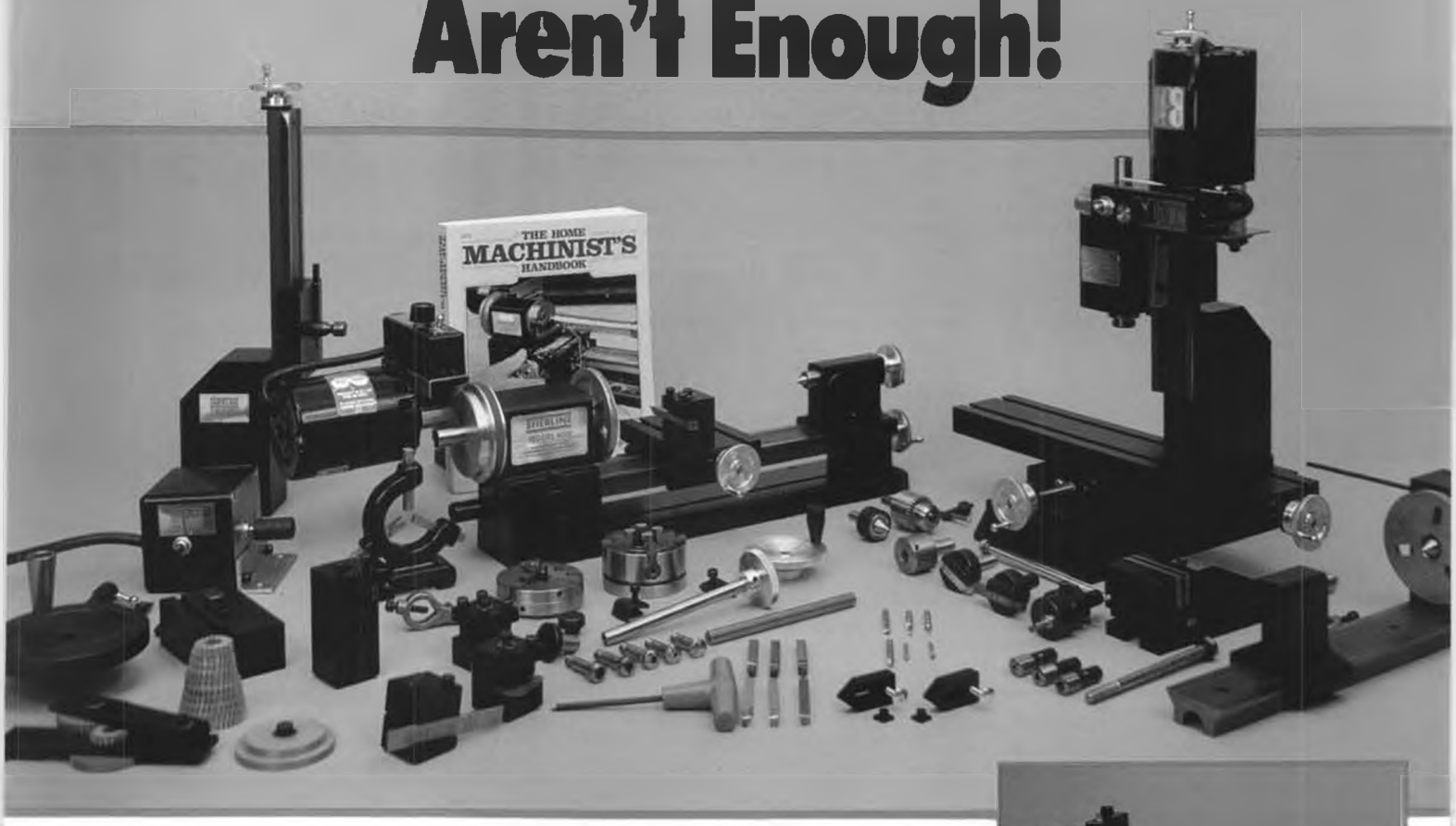
Lack of familiarity with the ONAIR's final approach habits combined with an excellent glide ratio, caused me to overshoot the planned landing point on the large paved landing area. The ONAIR touched down a little hotter than planned, burned off very little speed, then skimmed over an area on the edge of the pavement infested with small, round rocks. Here is where it came to rest. Its hard, smooth plastic main skid took up the shocks just fine, but the tail skid received significant damage. A narrow, plywood skid plate was epoxied to this factory tail skid to prevent future damage.

Some very small dents in the wing were partially removed with the application of heat from an air gun. Care must be taken not to overheat and melt the plastic.

The instructions depict the repair of an ONAIR with a broken tail boom. Indeed, I have heard that on rough landings the ONAIR's tail boom can break. To me, this seems likely to happen due to a stress point located near the trailing edge of the wing.

CONTINUED NEXT MONTH

SHERLINE...When Hand Tools Aren't Enough!



THE SMALL SOLUTION TO BIG PROBLEMS

Eventually every modeler will find they need a part which cannot be purchased or built with ordinary hand or power tools. Now, SHERLINE tools fill the gap between makeshift hand tools and expensive professional equipment. SHERLINE tools are used throughout the world in industry, schools, labs and by the hobbyist...whenever there is a need for small, precision machined parts. They are operated by engineers, scientists, technicians and model makers to produce prototype parts in metal, plastic and wood.

The equipment's compact size makes it perfect for any home workshop

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Craftsmen should have no problem operating SHERLINE miniature machine tools, for they are designed to be operated by people with a "common sense" knowledge of mechanics. The skills of an experienced machinist are not required. A full color 44-page manual on machining practices and guide to available accessories is included with each mill or lathe just to make it even easier.

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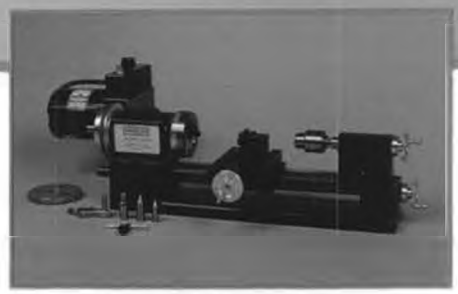

The Model 4000-A 3-inch lathe comes complete with everything you need to get started as a machinist. Included with the lathe is a faceplate, dog, 3-jaw chuck and a tailstock chuck and key.

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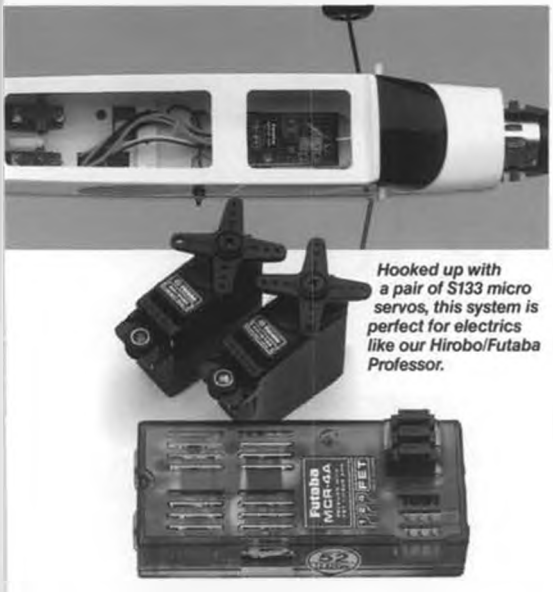
THE ATTACK 4NBL

Our newest 4 channel system has something for everyone. In fact, the Attack 4NBL is such a versatile performer we've customized it for all kinds of radio control fun.

ATTACK ELECTRIC

The 4NBL/MCR system is destined to become a favorite with electric flyers. This Attack system comes complete with our new MCR-4A integrated receiver/speed control. This remarkable device incorporated a four channel receiver and a MOSFET speed control into one very compact, very light and very efficient package. It also incorporates BEC to eliminate the need for, and extra weight of, a receiver battery.



Hooked up with a pair of S133 micro servos, this system is perfect for electrics like our Hirobo/Futaba Professor.

The MCR-4A four channel receiver/MOSFET speed control weighs just 1.5 oz. and can easily handle 280 to 540 size electric motors. 1.24" x 2.92" x 0.63".

SILENT ATTACK

There's a 4NBL system for sailplane flyers, too. With the Attack glider package you get a pair of S133 servos, R114H four channel receiver and a 250mAh NiCd pack. Again, when size and weight of the airborne package is critical, Attack is the answer.

Transmitter/T4NBL				
RECEIVER	SERVOS	BATTERY	FREQUENCY	TYPE
MCR-4A	S133(2)	BEC	72MHz	Electrics
R114H	S133(2)	NR-4K	72MHz	Sailplanes
R114H	S148(3)	Dry Case	72MHz	Aircraft
R114H	S148(3)	Dry Case	75MHz	Truck/Boat

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Looking for the perfect system for ARF and conventional sport aircraft? Once again, it's Attack to the rescue with a high value package including R114H receiver and three S148 servos.

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The ergonomically designed T4NBL transmitter features comfort contoured case and adjustable length control sticks.

No matter which 4NBL system you choose, you'll also get our new four channel Attack transmitter.

Loaded with extras like adjustable stick gimbals, servo reverse switches and a rechargeable NiCd pack, the T4NBL transmitter also features a comfort contoured case and neck-strap for fatigue free operation.

The R114H and MCR-4A receivers both meet the new 1991, 20KHz specifications.

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In the turns. In the straight-aways. You're in control. That's why Tamiya, makers of the best-selling monster trucks in America, built the Nissan King Cab, so you'll stay in the lead.

Everything about this Nissan King Cab is exciting. From its mammoth spiked racing tires, to its ball bearing type differential, it out-handles the others.

For example, an angled front-end allows for better handling when you're landing after a jump. While a fiberglass reinforced subframe adds stiffness. This King Cab accepts a broad range of gear ratios to compensate for various track conditions. You'll also find six special, sealed ball bearings in the transmission for increased performance and spur gears of 70 teeth and 77 teeth. What's more, optional, hop-up parts include assorted pinion gears so this beauty can easily adapt to different track conditions.

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