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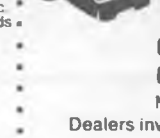

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ON THE COVER

One of the most attractive and nicest flying models at this year's Top Gun meet was Mike Barbee's DeHavilland DH-82 Tiger Moth, which finished in 7th place and also won a special trophy for Best Civilian Aircraft. The photo was taken by Wally Zober, whose complete report on Top Gun '94 will appear in next month's issue. Inset. Another beauty of a biplane is the sport scale Super Skybolt from Great Planes, built and photographed by George Voss for a Products In Use review article—see page 46.

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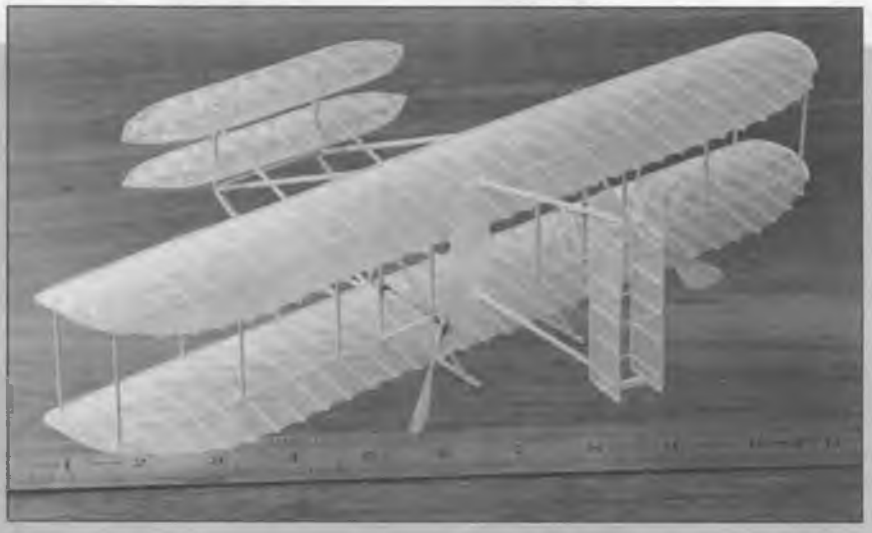

We'd bet that Australian modeler Thomas Wielecki never fails to draw a crowd whenever he brings out his Peanut scale Wright Flyer II, an unlikely subject for a successful FF model but which has turned in a very creditable best time to date of 22 seconds indoors. According to Thomas, "Although the model looks complicated, it is very simple to build. Details such as scale rib spacing, functional rigging, twin pusher props and biplane canards make the model stand out from conventional designs." Stay tuned—we've asked Thomas for a construction article. *Thomas Wielecki, 4 Princess Ave., Rosebery N.S.W. 2018, Australia.*

Jim White of Hudson, New Hampshire writes: "I started modeling in the late '40s with stick-and-tissue rubber jobs, and drifted in and out of the hobby for years. Since my son became an interested teenager, I have been into RC, but still continue on with my first love—stick-and-tissue."

Jim enclosed a photo of his beautifully built, Joe Weathers designed WX-48R rubber job, presented as a construction feature by Ken Hamilton in the March '92 *Model Builder*. An interesting challenge with its four-blade prop, large wing fillets and aluminum tube flying surface outlines, Jim reports it's also been a challenge to trim, with its high wing loading and mid-mounted wing. Covering is silkspan and dope, and the wheels are made from the bottoms of aluminum beverage cans. *Jim White, 155 Robinson Rd., Hudson, NH 03051.*

RCers who have been around long enough will remember VK Model Aircraft Co., operating out of Williamsville, New York. The Challenger, pictured here with builder Robert Fregeau, was one of VK's kits, and retailed for only $19.95. About his present-day Challenger, Robert writes: "My VK Challenger was built in 1963 but not flown until 1989. At that time it was recovered and refinished with MonoKote as the original silk had weakened beyond use. It has had a total of 10 flights, flies beautifully and is now retired for good to the ceiling of my hobby room. I fly with the Northern Connecticut Radio Control Club at our field in Ellington, Connecticut." *Robert Fregeau, 45 Porter Rd., East Longmeadow, MA 01028.*

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This semi-scale, electric-powered P-51 is the work of Scott Hartman, whose Pondside seaplane and Lazy-H biplane have appeared in *MB* as construction features. The P-51 is a seven-cell model, currently flying on a 19-turn Pocket Rocket ball bearing car motor with a 3.5:1 Master Airscrew gearbox. Best props to date have been the APC 11x8 and the new Master Airscrew wood electric series 12x8. Scott says he plans to try one of the new brushless motors on eight or ten cells for some aggressive fighter-type performance. *Scott Hartman, Rt. 2, Box 36-16, Fritch, TX 79036.*

When St. Louis flier Sean Meetre wanted all-out, no-hold-barred *performance* out of a sport RC model, he didn't beat around the bush. He built a Great Planes Ultra Sport 40 (already a potent machine in its own right) and modified the front end to accept an O.S. .61 FSR. Sean reports the vertical climb performance is unlimited (no kidding!). Control is via a Futaba FM radio, and the covering is white and metallic plum MonoKote. The model is pictured here with Sean's wife, Tracy, and we had no problem determining the prettier of the two! *Sean Meetre, 5532 Sutherland Ave., St. Louis, MO 63109.*

George Gaveras of Athens, Greece writes: "The Brigadier was built from *Model Builder* plans after my disappointment with a commercial 'trainer.' It originally was powered by a Cox Black Widow, later replaced by an Enya .049 TV II. It flies great, the idle is really low for such a small engine. Covering is Solartex. The wing is fitted with drooped leading edges. This modification took place during its third reconstruction. It has crashed five times now, because we fly in a park. We are talking about real damage! But it is still maintained in flyable condition. These kinds of models make the best primary trainers!" *George S. Gaveras, 15 Artemidos, Galatsi, Athens, Greece 11146.*

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DEALERS: Write For Details On How Your Name Can Appear In This Column

over the counter

TRIPLE-THREAT TREAT

Sig Mfg. Co. recently announced its new Tri-Star, a futuristic pusher canard by LeRoy Satterlee that can be flown as a slope glider or with .09-.15 glow or even 05 electric power. The fuselage has enough room for a full-size two- or three-channel RC system—no mixing required. The kit is supplied with foam wing cores and *laser-cut* balsa and plywood parts for unequaled accuracy. Flying weight for the 47-1/2 inch span model ranges from 18 ounces for the glider to 43 ounces for the electric version. Tri-Star kits are priced at $69.95 retail and should be in hobby shops by the time you read this. From Sig Mfg. Co., 401-7 S. Front St., Montezuma, IA 50171; (515) 623-5154. FAX: (515) 623-3922.

CARB HOOK-UP MADE SIMPLE

Four-stroke engines, with their rear-mounted carbs and resulting minimal firewall clearance, can be a real hassle when it comes to hooking up the throttle linkage. The folks at Du-Bro have greatly simplified this job with their new Four-Stroke Throttle Linkage—a quick look at the photo will reveal how it works. Installation requires drilling and tapping a hole in the engine mount. Available now in hobby shops, at a suggested retail of $3.95. From Du-Bro Products, 480 Bonner Rd., Wauconda, IL 60084; (708) 526-2136.

TOP FLITE'S T-6 TEXAN

One of the most popular WWII aircraft, the AT-6 Texan, is now a Gold Edition Warbird kit from Top Flite. Drawn to approximately 1/7 scale, the all-wood model spans 69.4 inches, can take a .61-.91 two-stroke or .91-1.20 four-stroke, and is designed to go together easily and accurately. The kit retails for $249.99 and is complete with injection-molded ABS cowl, vacuum-formed "greenhouse" canopy and various scale details, decal sheet with both Army T-6 and Navy SNJ markings, and lots more. If you want to install retracts, any standard pneumatic system will work—nothing special required. Full particulars are available from Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021.

HIGH-PERFORMANCE .061

Carlson Engine Imports is the exclusive U.S. importer of the new Czech-made MP JETS .061, offered in both glow and diesel versions and with either a standard UC/FF venturi or an RC carb. All are dual ball bearing engines, and all come with mufflers. Quoted performance figures for the diesel range from 10,700 rpm on an 8x4 APC prop to 21,400 with a 5.7x3 APC. The venturi engines (glow and diesel) are $60 each; $70 for the RC versions, and you can get either the glow or diesel with both

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

a venturi and an RC carb for $75. Add $4 S&H for each order. Carlson Engine Imports, 814 E. Marconi Ave., Phoenix, AZ 85022; (602) 863-1684. A full catalog is available for $1.

NEW ACCULAB SCALES

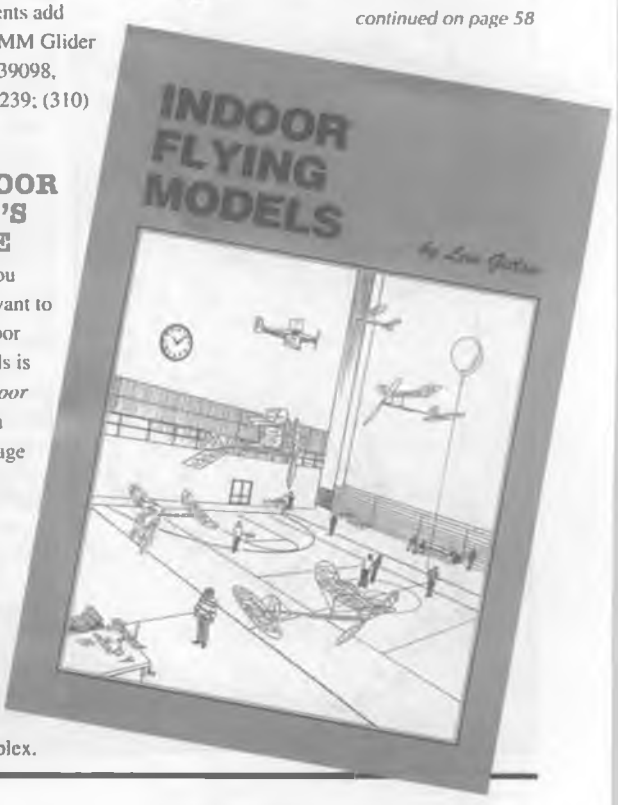
Champion Model Products is handling Acculab's new line of high-tech electronic digital scales—14 scales in all, all with redesigned circuitry and improved calibration software for better performance and stability. These scales weigh in both grams and ounces, include a tare, have a non-slip ABS housing, and operate on AC or batteries. Prices start at $85.50 including UPS. Complete details and ordering info can be had by sending a large SASE to Champion Model Products, 880 Carmen Ct., La Verne, CA 91750; (909) 599-3348.

MM'S COMPETITION HLG

MM Glider Tech's "Commoner" is a 59-1/2 inch span competition RC hand-launch ship that combines simple, straightforward design and construction with contest-winning performance. At 480 square inches, the Commoner is the biggest Class A sailplane we know of. Average flying weight is 13 to 13.5 ounces, for a wing loading of 4 ounces per square foot or less. Wing airfoil is the SD7084. Construction is all wood, and the kit comes with machine-cut parts and a full hardware package. *MB* Soaring columnist Bill Forrey flew one of the prototype Commoners and had good things to say about it; see his comments in the June '94 issue. Commoner kits are now available in hobby shops or direct from MM; price is $41.95 plus $5 S&H; California residents add $3.46 sales tax. MM Glider Tech, P.O. Box 39098, Downey, CA 90239; (310) 923-2414.

AN INDOOR FLIER'S BIBLE

Everything you could possibly want to know about indoor free flight models is contained in *Indoor Flying Models*, a definitive 184-page work written by Lew Gitlow, proprietor of Indoor Model Supply. All types of indoor models are covered, from the most basic to the most complex. In addition to a wealth of how-to information, the book contains loads of model plans, many of which are full size—some of them are even from IMS kits. Considering the work that went into this book and the valuable info it contains, it's a bargain at $25 postpaid. Order your copy from Indoor Model Supply, P.O. Box 5311, Salem, OR 97304; (503) 370-6350.



NO-FLEX CONTROL SYSTEMS

Last month, *MB* columnist Rick Allison expounded on the importance of using precision hardware in your model's control system. An example of such

continued on page 58

When contacting the manufacturers/distributors mentioned in Over the Counter, please tell them you read about their products in *Model Builder* magazine!

BY FRANCIS REYNOLDS

Propellers Again!

Our discussion about propellers in the April '94 column generated a lot of letters. I have several conflicting personal reactions to this: 1) They must think I know what I'm talking about. I wish I did; 2) I should write more about props, since they like the subject; 3) I should avoid the subject of props, since more letters make more work for me. In spite of the logic of #3, let's look at several of those letters.

MULTIPLE BLADE PROPS

Clark Calkins of Walnut Creek, California wanted to know, "Is there any difference in efficiency just due to the number of blades alone?"

I studied three of my aerodynamics books, looking for a specific answer—an answer in words, not mathematics. The book *Design for Flying*, by David Thurston, comes the closest. Quoting in part from page 161: "A study indicated that a three-blade 76-inch prop was slightly more efficient than a 76-inch two-blade, and much more efficient than a 74-inch two-blade. However, an 80-inch two-blade was the most efficient of all. . . . As a general rule, unless the diameter is limited by tip speed or clearance problems, a two-blade propeller will be lighter, cost less, and be as efficient as a three-blade propeller capable of delivering the same engine power."

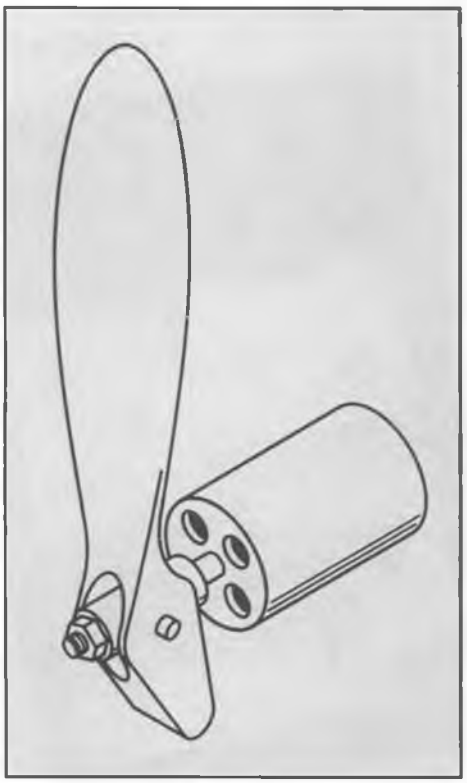


Figure 1. Dynamic balance (not to be confused with static balance) is automatic on a single-blade folding prop such as the one shown.

Using a large diameter definitely helps efficiency, but how many blades to put into that diameter becomes a judgment call. On page 301 of *The Design of the Airplane*, Stinton writes: "The efficiency of a propeller is affected by a number of factors. One is the number of blades (each sheds a system of trailing vortices which upsets the others)." On page 303, Stinton asserts that four-blade propellers produce about 95 percent of the efficiency of two-blade props.

Clark also asked, "How does propeller efficiency vary with rpm?" That one too is involved. It will depend on the tip Mach number, and whether the plane speed changes so as to keep the angle of attack of the prop constant. Probably a prop is the most efficient when its blades are working at the maximum lift-to-drag ratio of its airfoil at the Reynolds number it is working at. I didn't find an efficiency formula with rpm in it. Props can be quite efficient (around 70 or 80 percent) at most any rpm if the rpm is reasonable for the forward speed present.

The second propeller letter I want to report on, and one with which I take issue, was sent by the president of a company which has developed some modeling software. He invited me to publish the letter, so here are parts of it:

"In developing [our software] we made many measurements of rpm, current, and thrust for multi-blade props (two to eight blades) being driven by electric motors. . . . In general, it appears that thrust decreases with increasing the number of blades." He then presented data to justify his statement, showing rpm, motor current, and thrust for props with two to eight blades.

The data did show that in that particular test, thrust decreased as the number of blades increased. However, ignored was the important fact that the current went up and the rpm went down with each added blade. The reason the thrust went down with more blades was that they were progressively overloading the motor by adding blades.

If they had instead used an oversize two-blade prop to overload the motor and compared it to a properly sized two-blade, they would have concluded that "large props generate less thrust than small props." Likewise, they could just as easily have "proven" that more blades produce more thrust, by testing an oversize two-blade on that motor and comparing it to the results from a three- or four-blade of appropriate size.

In order to even attempt to show categorically that multi-blade props produce less thrust than two-blade props, the rpm and the torque would have to be held the same for every different prop used in the test. Meaningful scientific or engineering comparisons require that only one test variable be allowed to change at a time. In this case they allowed the rpm to drop and the current (and therefore the torque and power) to increase.

The letter goes on to say, "We can use the software with confidence to predict the changes in thrust with increasing the number of blades, all other parameters being held constant." But there is no indication from the letter that they ever did hold the parameters of rpm and current constant (by tailoring blade area and/or diameter).

Power is rpm times torque (the input horsepower to the prop is the rpm times torque in pound-inches divided by 63,025). In the above case, adding blades increased torque (as indicated by higher motor current), but the rpm decreased. Without knowing more about the tests and the motor used, we don't know whether the power going into the prop was less or more with more blades. If the motor efficiency was decreasing with increasing load (and it probably was), the output power to the prop may well have been less with more blades, even though the input power to the motor was more.

SINGLE-BLADE PROP BALANCING

I received another related letter from a reader who asked not to be identified, regarding single-blade prop balancing on electrics. My answer to him was as follows:

I've flown very few electrics,

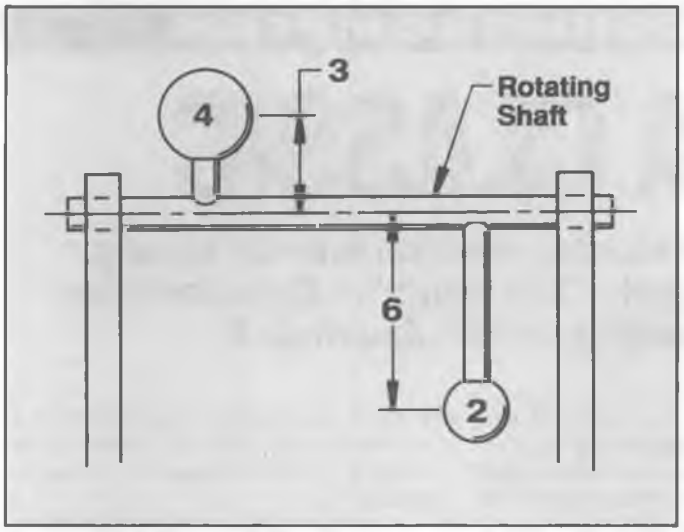


Figure 2. An example of static balance and dynamic imbalance.

and none with single-blade props, but the following is my engineering judgment on the questions you ask.

Yes, most free flight rubber-power folding single-blade props have the counterbalance extended somewhat from the hub. The farther out from the shaft the weight is, the less it has to weigh in order to statically balance the weight of the single prop blade. That's good. But the farther out the weight is, the greater the aerodynamic drag on it, and that's bad. We have to compromise.

In a rubber job, the prop speed and flight speed are very low, so the drag of the counterweight would be low; but rubber jobs, with their limited power and energy, must be very light. The extended weight will be lighter because its moment arm is greater. (In order for the prop to balance, the blade weight times its moment arm must equal the counterweight's weight times its moment arm.)

In electrics, weight is less important than in rubber jobs, but the rpm is hundreds of times higher, therefore we need to put the weight close to the hub. Here we are most concerned about the rotational drag of the counterweight, not its contribution to the drag of the airplane. We're going to fold the prop to reduce its drag in the glide; but when it's producing thrust we want to minimize the torque required to just swing the draggy counterweight around. (For this discussion, let's assume the prop blade and counterweight are a single rigid unit attached to the motor shaft so that the prop blade can swing forward and back freely, as shown in Figure 1.)

The torque required to turn the blade produces chiefly thrust; the torque required to turn the counterweight produces higher current, more heat, shorter duration, and less thrust (because of the lower rpm resulting from the greater total torque). Unless we do a good job of designing the counterweight, we can easily cancel out the inherent advantages of the single-blade prop.

In the case of the free-swinging single-blade prop in Figure 1, centrifugal force holds the blade out and the prop achieves dynamic balance automatically. What is "dynamic" balance? If we put a prop in a balancer and find it stays in any position in which it is placed, it is statically balanced. Spin that same prop at high speed, however, and it may be "out of balance"—especially a rigidly mounted single-blade prop. Clearly, static balancing isn't the whole story.

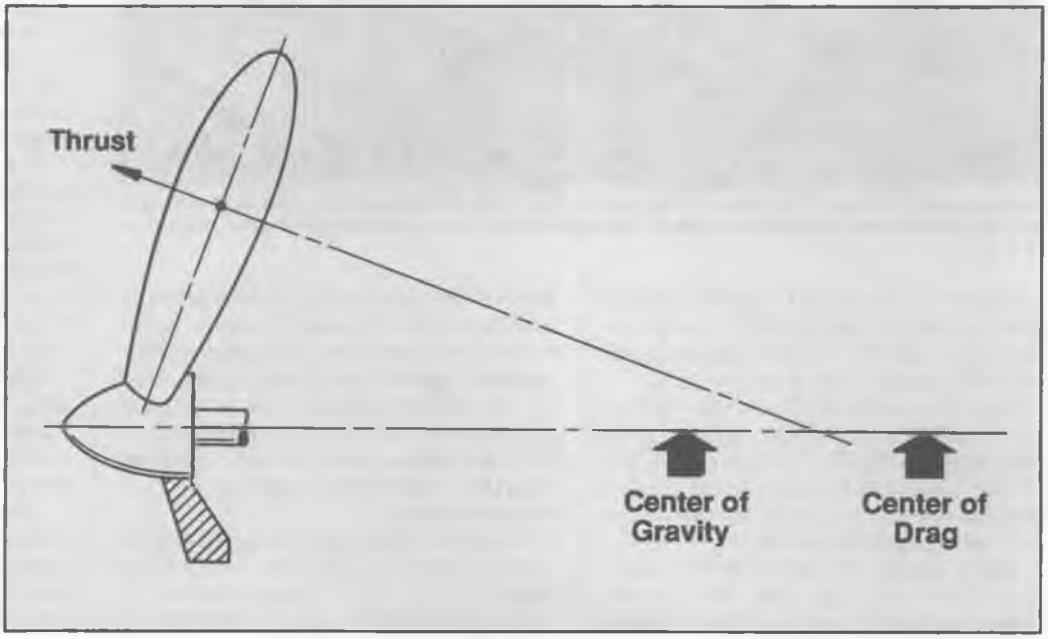
One form of dynamic imbalance can be seen in Figure 2. The rotatable object is statically balanced, since 3x4=2x6; spin this object at high speed and the machine will vibrate badly and the bearings will see high cyclic loads. You can visualize that at speed, the centrifugal force from the weight at one end of the shaft is trying to pull that end of the shaft sideways, while the other weight is trying to pull the opposite end of the shaft in the other direction! We could dynamically balance this rotor by adding opposing weights at suitable moment arms to statically balance each end of the rotor. In the dynamic balancing of automobile tires, weights are added to the rims at both the outer and inner sides of the wheels. Wheels can be statically balanced by adding weights at the outside only.

In propellers, we can have another form of dynamic imbalance: aerodynamic imbalance. This can occur in any propeller if the area, length, shape or pitch of the blades differ from each other; but it's the worst in props with a rigidly mounted single blade, such as those used in control line speed. The aerodynamic imbalance is then due to the imbalanced thrust of the single blade. At one moment the thrust is to the right side of the airplane centerline and is tending to yaw the model to the left; the next moment the thrust is below and tending to pitch the model up, then right, then down, etc. One thing we might do to improve this situation would be to angle the blade back so that its thrustline passes close to the center of gravity and the center of drag of the model, as shown in Figure 3. Then the thrust would always be pulling directly on the center of the model and the cyclic yawing and pitching forces would be greatly reduced.

The above fix on a rigidly mounted single blade wouldn't eliminate the cyclic dynamic imbalance loads on the motor bearings; but a folding single-blade prop will. When the prop/counterweight assembly is

continued on page 23

Figure 3. How tilting the blade back helps the aerodynamic balance on a single-blade prop.



BUILDING A CLASSIC

Old Time Stunt continues to grow, a handful of manufacturers turning out excellent kits for a variety of subjects. This month's column includes a mini kit review for an old favorite, the All American Sr.

Old-Time stunt is an event that attracts fliers and spectators for a number of reasons.

The planes display the beauty and craftsmanship associated with precision aerobatics. They also offer the classic lines of the pre-1952 era of control line model aviation that produces nostalgia among the old-timers of the hobby and an interest among those interested in its history.

That's why, as noted in this column in the past, there is a good supply of kits being produced for some of those old designs. That's good for competition because it offers an opportunity for fliers to participate without having to build from scratch.

Ain't she pretty? This is the All American Sr. discussed in the text, built by Jim Cameron from the Golden State Models kit. Model was covered in white tissue or silkspan and trimmed with red tissue cut out and doped in place. Power is an O.S. .35.

One of the most distinctive of the old-time stunt designs is the All American Sr., a Hal deBolt design kitted by Dmeco in 1951. This model is available in kit form today from not one but two manufacturers. Some time ago we had occasion to acquire one of each.

We reviewed the general differences in the two kits in the September 1992 column, observing that both appeared to be excellent in quality, though slightly different in manufacturing approach. Both offered updated plans with contemporary construction notes. We noted that the Golden State Models kit offered precisely sawn parts but wood of varying quality, while the Flite Line Products kit offered die-cut parts and excellent wood. Since that time, Golden State Models has changed hands, and the new owner, Bob Ellis, sent us an updated version of his company's All American Sr. kit.

We promised in that 1992 column to offer some impressions of actual construction of an All American. To provide that insight, we turned one of the kits over to a member of our "panel of experts," Jim Cameron, and asked him to offer his impressions of the building process. The kit selected was the updated Golden State Models kit; we're hoarding the Flite Line kit for future construction in our own workshop.

A number of fliers have observed that the All American is a plane that needs to be built in a particular sequence for best results. Our timing in asking Jim to talk us through construction of the All American was perfect—he was just about to start building. What follows are his construction notes:

"First impressions. I like to see full-size plans; this kit has a nice, easy-to-read set. The hardware package contains a nylon bellcrank and control horn; leadouts and dural landing gear struts are also included.

"Parts looked to be stacked and cut on a bandsaw, which gives a very accurate set of ribs. As with any stack of symmetrical ribs, don't take the stack apart before marking the top of each rib with a felt-tip marker. I also number each rib so I know they will sit in the wing just as they were in the stack. If one rib gets flipped, it could cause a warp.

"One thing that might cause a beginner some problems is that there are no step-by-step instructions. In a note from Golden State Models, some things to remember were discussed, including: 'You must know how to read the plans.' My suggestion is to take your time and think what your next move will be before you put glue on any parts. Golden State's notes also warn the builder to cut the holes for the leadouts before sheeting the leading edge area.

"I replaced the pushrod with 3/32-inch music wire. The kit had 1/16-inch wire, which I felt would flex. I also added support for the bellcrank platform over and above that shown on the plans.

"A note about the leading edge. I put the 3/32-inch leading edge sheeting on the ribs first, then sanded the front flat to accept the 3/8x1/2 leading edge. The kit does not have V-notches in the ribs.

"Fuselage. A good idea with any plane you build is to do a dry setup of the parts, engine and tank before you glue anything. I found that my tank would not fit with the formers supplied, so I had to cut two new ones. I also added some extra fuselage formers in the area of the leading edge/fuselage joint.

"Elevators. I like to put some 1/64-inch plywood under the control horn to prevent the horn from digging into the balsa. I also added a rib support, which can be seen in one of the photos.

"In conclusion, it is my opinion that unless you are a good scratch builder, you could not do better than this kit. The wood selection was very good. I did replace some sheeting, which turned out to be 10- and

14-pound wood.

"One last tip for any project: If a part does not fit, *make* it fit before gluing. Don't be afraid to replace the piece if necessary."

As the photos show, Jim's efforts led to an attractive reproduction of one of control line's most famous aircraft. All American kits can be obtained through hobby shops or from one of the following two sources:

•Golden State Models, 2368 Ave. 396, Kingsburg, CA 93631.

•Flite Line Products, Route 9, Box 437, Lubbock, TX 79423.

By the way, both of these companies offer other kits and control line products. Ask them for a catalog.

ENTRY-LEVEL CL RACING

There are a number of competition classes that were conceived years ago as a simple or entry-level event and which evolved beyond that to a high-tech or high-cost event. One of these is scale racing (Goodyear), which now requires expensive engines and quite a bit of racing know-how. Several areas of the country have developed local variations of the event, restricting engines or other aspects in order to recover the slower, easier form of competition.

One of these events is having some success in the Las Vegas area. The following is a report from Manny Gomez of Henderson, Nevada:

"Our club is the Vegas Area Model Plane Society (VAMPS), based in Las Vegas. We have about 25 active members and another 15 or so that are inactive. Originally founded as an old-time/antique free flight club, we recently reorganized to include CL and modern FF activities.

"About half of the members actively pursue CL interests, ranging from competitive stunt flying to proto speed. Last summer we created a team race event that has proven very popular and an excellent introduction to the discipline required for competition in any venue.

"The rules require any plain bearing .15 cubic inch engine and any airplane that resembles in profile a recognized racing aircraft. Suction fuel systems are required, although any fuel and propeller are allowed. The engine must be secured to the bellcrank per current AMA rules and flying is done on normal .015-inch, 60-foot stranded lines.

"The first generation racers were mostly diesel-powered Sig Busters or Shoestrings. The engines were either Silver Swallows (a Chinese .15) or MVVS Juniors (a Czechoslovakian .12). Both engines are well made, durable and affordable. The results were speeds of about 55-60 mph, lap times of 4 to 4.5 seconds and a completed airplane that cost about $60. Even if a flier had no field support equipment whatsoever, they could still go racing for less than $100!

"Needless to say, the event has been very popular and has brought many aspiring competition fliers out of hiding.

"We race two-up with heat races of 70 laps requiring one pit stop, and a final heat of 140 laps with two pit stops. The second generation racers are sporting O.S. Max .15FPs or Fox .15s in custom-built airframes of about 100-120 square inch wing areas. Completed weight is 12-15 ounces. Lap times are in the high 3-seconds. As you can see, these speeds are still very manageable even for a relatively inexperienced flier.

"We fly this event on an asphalt parking lot courtesy of the local airport manager, who is very supportive of our club activities. I highly recommend this event to any club looking to create an entry-level competition event. It also is a good spectator event.

"Our monthly meetings are held at the North Las Vegas Air Terminal, 2772 N. Rancho Dr., North Las Vegas, Nevada, the fourth Monday of each month except December. We welcome visitors, new members and correspondence with all interested modelers."

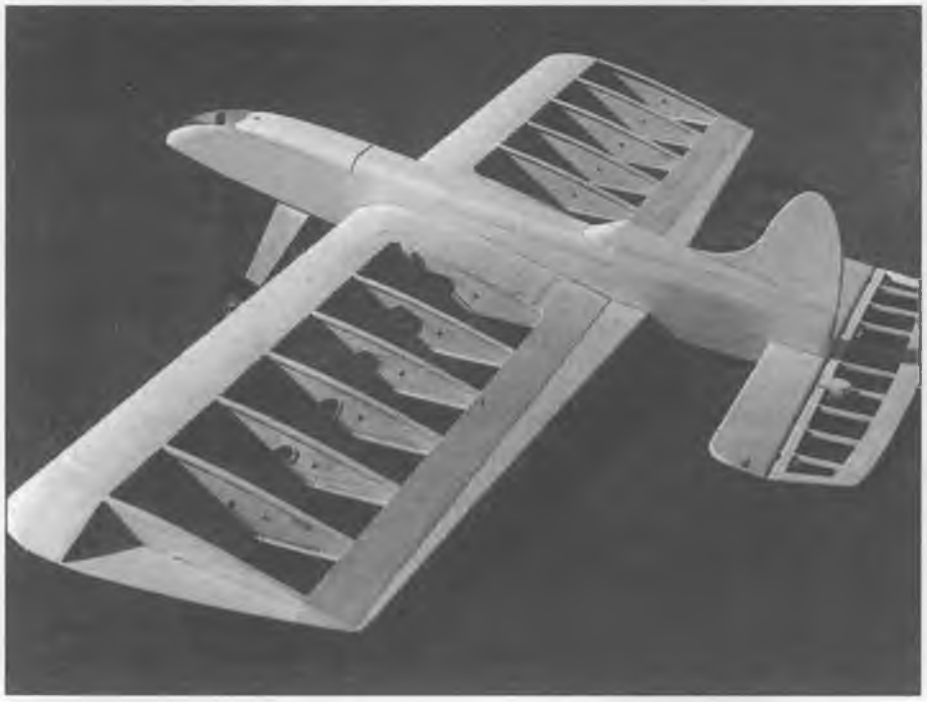
The VAMPS can be contacted through Manny Gomez, 11 W. Pacific Ave., Henderson, NV 89015.

COMMERCIAL CORNER

•Modelers with an eye for the exotic may be interested in obtaining the catalog of Mejzlik Modellbau, the mail-order business of Tomas Mejzlik, a member of the Czech combat team. The catalog is full of exotic combat, speed and racing equipment, much of it from Russia. Write to Mejzlik Modellbau, Jurkovicova 19, 638 00 Brno, Czech Republic (Europe).

•Jomar Products has announced the availability of an electronic automatic retractable landing gear switch—just the thing for extra impression points in your stunt plane! The device uses a standard RC servo, but does not require extra lines or RC control box. Quoting from the press release: "Just before release, your helper turns on the switch. After an adjustable time delay, the gear will retract only if the engine is running. When the engine quits, the gear will extend automatically." The price is $39.95. For information, write Jomar Products, 3440 Riverhills Dr., Cincinnati, OH 45244.

As always, photos, club news, contest information, technical tips and questions are welcomed. Write John Thompson, 295 W. 38th Ave., Eugene, OR 97405. Send electronic mail to 73473.1407@compuserve.com. ***MB***



■ **LEFT: Jim's framed-up All American Sr. prior to covering. He made a couple of minor changes as outlined in the text.** ■ **ABOVE:The ingenious automatic retract servo controller offered for control line planes by Jomar Products. See text for details.**

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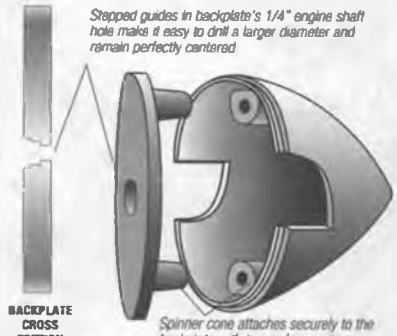

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DEAR JAKE

Advice For The Propworn

DEAR JAKE

Has anyone flown a man-powered aircraft across the English Channel yet?

Wes in Wendover, MA

Dear Wes:

Where have you been? The Gossamer Condor accomplished that feat ages ago and won the £50,000 Kramer Prize. In fact, that was so long ago that hardly anybody is pursuing man-powered flight anymore. Many more challenging goals have been established by various prize donors since then, and most of them have already been achieved.

Marianna Constantine of Greece won the Maidenform Prize in 1987 for piloting the first woman-powered aircraft across the channel. In 1988, Auggie won the Chiquita Prize for the first gorilla-powered cross-channel flight. Sampson's channel crossing in 1991 claimed the Eastwood Prize for the first orangutan-powered flight. And currently, a greyhound named Bo has a claim pending confirmation for the Ralston-Purina Prize, to be awarded for the first kanine-powered channel crossing flight.

About the only two awards still unclaimed are the Willie Nelson Prize for the first goat-powered aircraft to fly across the English Channel, and the Goodyear Prize for the first human-powered blimp to make it across. Rumor has it that a syndicate headed by Tom Arnold is working on the second one.

Jake

DEAR JAKE

For the record, I would like to make the following public statement:

"There is absolutely no truth to the rumor that I used a Jetex assist to win the 1994 Frog Jumping Contest in Petaluma, California. Despite statements to the contrary by witnesses who claim to have heard a distinct escaping gas exhaust noise as my frog flew through the air, I can assure you that an implanted Jetex motor was not the source of these sounds, nor was my frog artificially propelled by any other means. My frog's record leap was the result of diet, exercise, and training. We won fair and square, and I stand behind our accomplishment."

Lewis Untemeyer and "Buzz"
San Luis Obispo, CA

Dear Lewis:

Yeah, but would you stand behind your frog? That diet you credit wouldn't happen, by any chance, to be made up primarily of three-bean burritos, would it?

Jake

DEAR JAKE

What's the difference between a four-*stroke* engine and a four-*cycle* engine?

Howard in Harrisburg, PA

Dear Howard:

Spelling.

Jake

DEAR JAKE

What did the implied initials G.B. stand for on the famous racing aircraft that was spelled out and called the Gee Bee?

Norman in Norman, OK

Dear Norman:

Any of several excellent books on the Granville Brothers provide the answer to your question. Gee Bee stood for Gatorade Bottle, because that's what the airplane was shaped like. They were originally going to call it the Emm Jay for Mayonnaise Jar, but they just weren't sure that that one would catch on. Wise change of mind, I'd say.

Jake

DEAR JAKE

I'm a nature lover, a model builder, and a sailing enthusiast. Perhaps that leads me to think on a slightly different keel than other folks (no pun intended).

I have always wondered if sailfish, those magnificent denizens of the deep with the spectacular dorsal fins, ever rise to the surface and use their sails to propel themselves just as a sailboat uses its sails. It is possible that blue and black marlins may be able to do this also.

Josh in Destin, FL

Dear Josh:

As far as I know, sailfish don't sail. Nor do nurse sharks nurse, nor star fish act. I am pretty sure, however, that sting rays do cost more to insure than regular Chevys.

Jake **MB**

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BIG CHANGES IN PATTERNLAND?

The AMA rules cycle is once again upon us, and there's a very good chance that the FAI's just-passed lifting of all engine displacement limits for F3A will also be adopted for AMA Pattern events. How will the sport be affected?

Competitive events like pattern are constructed of rules, defined by rules and have their futures shaped by rules. Without the AMA and FAI rulebooks, there would be no precision aerobatics event, at least in any organized national or international sense. The rulebooks put us together, keep us on the same page, and allow contests in Hoboken to run the same way (roughly) as contests in Modesto. The FAI F3A event is flown to identical rules in London, Ontario and London, England. I wouldn't have it any other way, for the simple reason that any other way wouldn't work.

Why the intro about rules? Two reasons: first, because it's AMA new rules proposal time once again and the results of the biennial National Society of Radio Controlled Aerobatics (NSRCA) rules survey have just been made public as I write; and second, because the FAI F3A international sub-committee on rules has just dropped the big one, voting to remove all F3A engine displacement limits in 1996! The 5 kilogram weight limit will be retained, and a new 2 meter length and 2 meter span limit adopted, but any engine may be used to power an aircraft constructed to those parameters. I assume the old maximum surface area rule of 150 square decimeters has been left intact, but that was never much of a limiting factor anyway.

Chances are good that more than just FAI pilots will feel the impact of this change. The just-compiled NSRCA survey results (recently published in *K FACTOR*, the NSRCA newsletter) made it clear that most pattern fliers (75 percent) want the AMA to go along with this change and institute a similar rule in the '96 AMA book. I know that the NSRCA Rules Committee, which is the official AMA Advisory Committee to the RC Aerobatics Contest Board, will propose such a rule, and I have little doubt that it will pass the final vote.

Opinion is divided as to what exactly will happen to pattern in 1996 as a result of this monumental change.

Some knowledgeable, thoughtful observers of the pattern scene expect only moderate change, spread over a two- or three-

■ ABOVE: Kip Jackson of Bellevue, Washington shows off his much-modified Salient Designs Boxer 1.20, which he dubbed "Venom." YS 1.20, Futaba radio, and about 9.5 pounds. Kip flies FAI class. ■ LEFT: Dave and Jean Olsen of Santa Rosa, California and their Fresh Aire II. Craft weighs an even 10 pounds, has a YS 1.20 on board with a JR PCM-10S for guidance. Finish was done by Dennis Breene, who also supplied this photo.

year transitional period, with a minimum of pain and expense. The reasoning here is that no present equipment is being outlawed, and that the state of the art in '94 and '95 (providing that the maneuver schedules don't change radically) will still be very competitive in '96 and '97. This is a reassuring view of the matter, and comforting. We'll call this Scenario #1.

Unfortunately, some other knowledgeable, thoughtful observers of the pattern scene fully expect the skies to crack wide open on 1 January, 1996, and a combination of Armageddon and Ragnorak to debut shortly thereafter, with the painful, convulsive death of Pattern As We Know It to follow at a discrete interval; film at eleven. This is Scenario #2, and there is nothing comforting or reassuring about it, unless you're the type that thinks "The Texas Chainsaw Massacre 2" should have had a G rating. The reasoning here is that natural pressures, both competitive and peer, will cause most of us to immediately build large, complicated, expensive airplanes, thereby emptying our wallets and discouraging newcomers by reinforcing the notion that pattern is a highly technical and fiscally draining event not easily mastered by one with a normal bank balance.

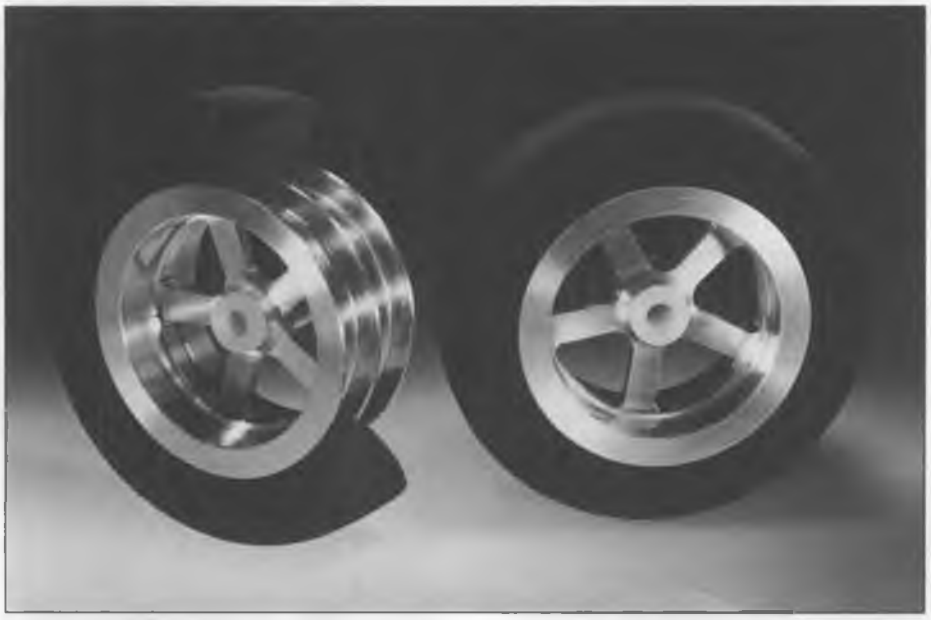
Whenever published opinion comes down equally hard on opposite sides of an issue, the truth lies somewhere in the middle. Anyone smart enough to decipher a modern newspaper can attest to this. I believe that such is probably the case here, but I must say that my opinion is a lot closer to Scenario #1 than it is to the "Twilight of the Gods" vision of Scenario #2.

I have reasons for believing that the new rules won't cause the sky to shatter and spew forth doom. First, I don't share the commonly held belief that all of my compatriots are the result of a secret government genetics experiment which crossed sheep with lemmings in an effort to create the perfect mindless follower. I think pattern people do rather better than the national average at thinking for themselves, and rank somewhere between the Norwegians and the Germans on the number of Stubbornly Held Opinions per Square Head scale.

Second, 5 kilograms is not that heavy, and 2 meters is not that big. The average 1.20 size ship is already 92 percent as wide, 94 percent as long and weighs 90 percent as much as this. In contrast, that same 1.20 ship replaced an average .60 size ship that was 93 percent as wide, 95 percent as long and 80 percent as heavy as it was. There will be growth, yes. Will it be outlandish? No.

There are a few engine options out there right now, such as the Webra 1.2 two-stroke and the Saito 1.50 SDP four-stroke, which would plug right into the present 1.20 airframes, stay within the weight limit, be fairly easy to keep under the 96 dB noise limit, and offer the same or a little more power than the supercharged 1.20s while not costing quite as much. They are viable options, and I expect that more than a few of us will try them as soon as they become legal.

There are more powerful engines presently available, such as the Moki and Super Tigre two-strokes, but they are heavier. Simple weight and balance calculations say it's very hard to put a 4-pound powerplant and exhaust unit in the nose of a 2-meter airplane and make the 11-pound limit. A very light, built-up structure with external bracing (I've heard 1500 square inch biplanes mentioned) would allow this, but there would be a stiff cost in structural rigidity, vibration resistance and especially drag. Add in the exhaust hardware (most of which would have to be fabricated), the difficulty of rigging and trimming it, the additional field assembly hassles, and the extra maintenance, and I think the resulting airplane would be an exercise in frustration. It would also fly extraordinarily well on a calm day if you were good enough to get it and keep it right. For that reason, I think someone, perhaps multiple someones, will try this approach. That's fine, somebody should (we all might learn something), and if it's one of my competitors,



■ **ABOVE LEFT: Nice, simply decorated Hanson Runaround by Dennis Breene. Plane features a built-up wing and stab for lightness. Saito .91, JR x-347 radio, and only 6.25 pounds! A sweet airplane, says Dennis. Obviously, big isn't the only way to go.** ■ **LEFT: The new ProMag wheels from Precision Model Products. Beautifully made, light, and very durable. More in text.**

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CRC Products' vest pocket multimeter belongs in every pattern pilot's toolbox. Features a switchable load for checking your flight pack.

then so much the better! Anything that keeps them too occupied with tinkering to practice is fine with me.

The majority of us will hang back a little, if history is any guide. The brave pioneers will cobble their best and brightest notions together. Some will succeed and blaze the trail; the rest will wind up as tombstones beside it. In a year or two, things will sort themselves out, and new hardware will arrive that will allow us to take more complete advantage of the new rules. My guess is that it won't cost much more (with inflation factored in) than the stuff it replaces, but I doubt if it will be any cheaper. Some people will quit flying pattern and (rightly or wrongly) blame the expensive technology. Others will take it up because of the irresistible lure of that same technology. But then, people have been doing both of these things for years. The final bottom line is that the sport will survive and prosper, and the best airplanes of 1998 will fly better than the best of 1994. This is called progress, and if we didn't keep making it, the K&B Torpedo .45 would still qualify as a hot setup.

The unlimited engine displacement rule is the biggie, but there are a few other newsworthy rules-related items to pass on. The 150 degree box is a dead issue, and in fact, was never a serious proposal at all. I'm very thankful for this. The idea falls under the category of taking something that was fixed and deliberately breaking it. New FAI schedules are in the works, but it appears as if they won't be radically different from the present ones. The present 96 dB noise limit will remain.

In AMA pattern, judging from the NSRCA survey results, I would look for the Pilot's Option rule for takeoff, landing and direction of flight to pass for '96. Most of the restrictions on airplane size, type and engine displacement will probably be removed in the Novice class, to encourage more sport fliers to give pattern a try by flying whatever they have handy. A brand new (not recycled FAI) schedule should appear for Masters class. Other than that, most of the changes on the horizon will be of the non-earthshaking, housekeeping sort. If you have ideas to the contrary or wish to submit a proposal of your own, the deadline for submission is September 1, 1994, for the '96-'97 rulebook. AMA HQ can help you with the deadlines and the proper forms.

NEW GOODIES DEPT.

While the focus has all been on bigger engines and airplanes, the new YS .91AC four-stroke has arrived and is generating a lot of interest from the considerable number of pattern folks who find even the present 1.20 planes a little large for their taste, their vehicle, or both. This engine is a real powerhouse, and while it is a bit heavier than the .60 two-strokes and the O.S and Saito .91 four-strokes, it definitely outpulls them. It also fits right into most of the existing .60 two-stroke kits without mods of any sort. I've flown a Boxer with this engine aboard, and in the air, it's very tough to tell from a 1.20-powered aircraft by sound, sight, or flight characteristics. I'll bet that YS

The CRC Products throw meter for checking control surface deflection. Simple and fast, and very practical.

Futaba is going to sell a bunch of these engines. If I was a pattern kit manufacturer, I wouldn't junk all my .60 size molds just yet.

Vern Koester at Precision Model Products has introduced the ProMag wheel, a unique aluminum wheel with a low-profile neoprene foam tire. As you can see from the photo, the hub is fitted with a center spline which helps retain the tire under side loads. The neoprene tire compound has been selected for durability, and the hub is machined from 6061 T6 aluminum bar stock and fitted with nylon bushings. The whole package is just about as high quality as you will see in this hobby. Weight for a pair of 2.5-inch wheels is a shade over 50 grams. ProMags are available in 2, 2.25 and 2.5-inch sizes, and will set you back $29.95 per pair. Replacement bushings and tires are available as well. Precision Model Products, 14423 Hix St., Livonia, MI 48154; (313) 464- 8594.

CRC Products of Lake Tahoe, California has recently upgraded their neat little control surface throw meter with new bushings and pointer, but the quality and accuracy remains. This is the only surface deflection indicator I know of that functions as well at the field as it does in the shop (the model doesn't even have to be leveled first), and it's as accurate as anything out there. At $20 per copy, it qualifies as a serious no-brainer. Get one.

In addition to the throw meter, CRC has a vest pocket digital multimeter that has been fitted with a switchable load for use as an ESV. It will test both four- and five-cell airborne packs, and comes packaged with the connector of your choice. The price is $40. Both the throw meter and the multimeter are available from Dennis Breene at Breene Aircraft, 109 S. Orange, Exeter, CA 93221; (209) 592 6708. ***MB***

MODEL DESIGN *cont. from page 15*

pivot-mounted to the prop shaft, the thrust tries to pull the blade forward, but the centrifugal force resists it. Pivoting the prop permits it to automatically dynamically balance itself.

It would be appealing to mount the counterweight far enough aft so that when the prop is working the blade is still angled aft to get the advantages of the instantaneous thrustline passing through the CG and center of drag, but don't! This configuration would be unstable. The blade would either swing full forward or full aft under power.

If you run development tests on single-blade props, or any propeller, *be careful!* Props can cut—I have the scars to prove it. Props that fly apart can do a lot of mischief. The vibration from unbalanced props can damage motors and tear airplanes apart.

PARTING WORDS

Don't improve it until it doesn't work. ***MB***

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HANNAN'S HANGAR

BY BILL HANNAN

"Life is too short to spend time doing anything except what you are passionate about."

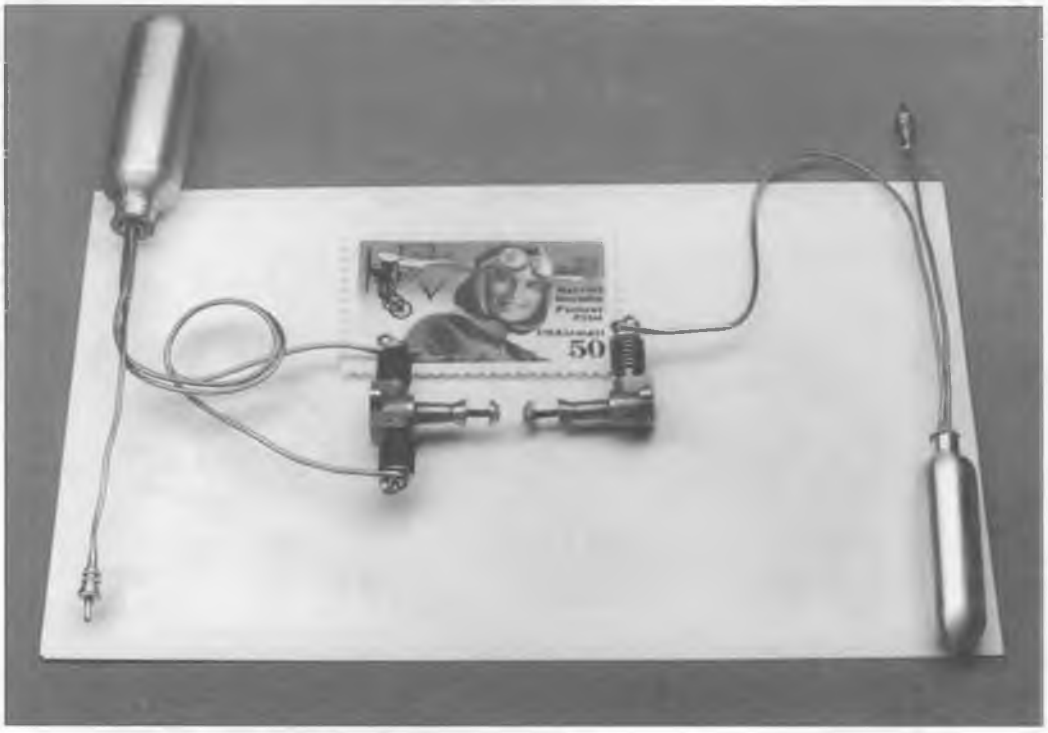
Our quotation this month is by George Mateljan, founder of Health Valley Foods. George was referring to his passion for producing healthful foods, of course, and has become famous for his dedication to top quality. Might not his philosophy apply equally to the recreational aspects of life, such as our chosen hobby?

SPEAKING OF DEDICATION

Bill Brown, who developed the classic Brown Junior spark ignition engines during the 1930s, remains passionate about producing powerplants today. We feel privileged to feature his newest creations, the GB-12 and GB-24 CO_2 systems. Bill's experience with this type of power dates back to the 1940s, and since then he has steadily refined the technology.

During 1991, Bill visited Stefan Gasparin, the leading CO_2 innovator in the Czech Republic, to exchange ideas. Each man has evolved different manufacturing approaches, but both have shared concepts freely. Stefan's cooperation is acknowledged in the "GB" (Gasparin-Brown) designations of Bill's new products.

Comparing the size of the GB-12 with a penny and a 3/8-24 spark plug from a 1930s-era Brown Junior spark ignition engine brings an appreciation for the degree of miniaturization that has taken place over the years. Bill Hannan photo.



The latest products from Brown Junior Motors are the twin-cylinder GB-24 (left) and single-cylinder GB-12 CO_2 powerplants. Beautifully built, and perhaps best of all, very reasonably priced—see text. Photo by Bill Hannan.

Originally conceived to provide quiet, clean power for indoor flying scale models, both engines are gems of precision workmanship and efficiency. As may be seen from our photographs, they are appealingly small—less than 3/4-inch high for the single-cylinder GB-12, and a mere 1-1/8 inch wide for the GB-24 twin. Interestingly, the original working drawings are 20 times actual size!

The units are amazingly light, with the GB-12 complete including fuel tank and Superior 3-1/2 inch wood prop weighing less than 3 grams. The GB-24 twin, with its 4-inch prop, tips the scales at less than 6 grams.

Both engines feature a cast metal crankcase, machined steel cylinder, aluminum cylinder head, and copper fuel line leading to a spun aluminum tank. Thanks to a tiny new filling valve design, these tanks may be charged with much less effort than older units, and the filler nozzles are more easily concealed in scale models.

We found both engines to start instantly and run beautifully at all speeds. They will also handle larger diameter props easily, if desired. Small enough to fit within Pistachio scale models, the GBs, by virtue of their power output, might be more appropriate for Peanuts or slightly larger models.

Considering the extreme manufacturing precision required to manufacture these jewels, the prices seem quite reasonable at $69.95 for the GB-12 and $99.95 for the twin. The chargers, which accept large-size CO_2 capsules, are priced at $24.95. Phone orders

may be placed with Brown Junior Motors, Inc. at (814) 237-7504. Visa and MasterCard are accepted.

THE PASSING PARADE

Too many of our fellow enthusiasts have "checked out" recently. Among them were noted free flight competitors Joe Bilgri, Tom McLaughlan and Pete Andrews; Claude Curry, who marketed models and owned his own Pitts Special; aviation publisher/dealer John W. Caler; and *Aviation Booster* editor/publisher A. Lee Spencer. In England, we lost P.T. "Pete" Capon, who introduced 1/72-scale solid models during the 1920s, helped build the Supermarine S6B Schneider Trophy winner, assisted Juan de la Cierva with Autogiros, was an active free flight modeler, and operated a hobby shop before his retirement.

How can we pay tribute to these departed companions? *Flyoff* newsletter editor Bob Hatschek suggests making memorial donations, listing such kindred spirits, to the Academy of Model Aeronautics Junior FAI Free Flight Fund, thus helping "to foster the development of younger free flighters to step into their shoes."

Alternatively, donations could be sent to the AMA museum to help finance the preservation of modeling history. Checks should specify the purpose, and be sent to AMA, 5151 E. Memorial Dr., Muncie, IN 47302-9252.

Magnificent Handley Page H.P.45 held by its builder, Gerhard Schuster, of Austria, is powered by four Gasparin CO_2 engines. We'd give our right arm to see this one in flight! Photo by Klaus Jorg Hammerschmidt.

GEE BEE NEWS

According to Anne Byers, Dr. Norma Granville recently located Zantford "Grannie" Granville's original pilot's license (signed by Orville Wright) and mailed it to Ted Blakely, who handed it to Delmar Benjamin, who carried it aloft in his Gee Bee R-2 during one of his inverted ribbon-cut airshow routines!

NEW GOODIES

•Ken Sykora's 1994 Old Timer Model Supply catalog has arrived. Illustrated with Otto Kuhni's sparklingly crisp line drawings, the glowing yellow-green booklet shows all manner of "good old days" free flight materials, plans, accessories and supplies. Examples include hinoki wood, bamboo, balsa, rubber, finishing materials, tissue, condenser paper, winders, and construction plans ranging from Peanuts through old time gas models, interspersed with philosophical quotations. For your copy, send $2 to OMS, P.O. Box 7334, Van Nuys, CA 91409.

•Denny Atkins and Ray Abadie offer their new Hobby Supply South catalog, which is brim-full of kits, supplies and everything in between. How about a videotape about the care and feeding of model engines? Or model construction kits from New Zealand and England as well as the USA? Accessories, tools, modeling books—from free flight to RC scale—it's all here. The catalog sells for $3, from HSS, 5060 Glade Rd., Acworth, GA 30101.

•Tireless Vern Clements has recently completed drawings of the 1938 Keith Rider R-4, the Schoenfeldt "Firecracker" as flown by Tony LeVier. The 1/12-scale plan we examined was delineated in Vern's usual conscientious manner, with plenty of useful suggestions for achieving success with a model of this fascinating racer. Sending $4 will bring a catalog/newsletter with pricing information on this and other fine Clements drawings, as well as his new line of clothing featuring illustrations from many of his drawings. Vern Clements, 308 Palo Alto Dr., Caldwell, ID 83605.

Don Campbell's China Clipper was made from an old Strombecker solid model kit, and is painted black in the manner of World War II identification models.

HANNAN'S HANGAR

Beautiful Bücker Jungmann Peanut by Dr. Tomas Hultgren, of Sweden, placed 4th in the English Interscale '93 contest.

• The North American Mustang is among the most documented aircraft in aviation history, but how much do you know about the Twin Mustangs? Now you can learn all about them in *Double Menace*. Well researched and written by David R. McLaren, the book examines the P/F-82s from their conception in 1943 through their retirement in the 1950s.

Fascinating is the description of testing the prototype, which almost literally refused to leave the ground! (The solution to

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Béatrice Demé, of France, displays Georges Chaulet's "Fantomette" RC autogyro. Georges is compiling a book about his experiences with autogyros.

that mystery may well interest builders of twin-engine model airplanes, regardless of design.) Even after that particular problem was solved, various mechanical and bureaucratic difficulties continued to plague the program, and at best the machines were considered to be a crew chief's nightmare.

Still, the Twin Mustangs were very useful for their all-weather and long-range capabilities, as conclusively demonstrated by Colonel Bob Thacker's famous record-setting flight from Hawaii to New York in the "Betty Jo," now preserved in the Air Force Museum.

Double Menace presents interesting anecdotes about these strangely-configured aircraft, such as the comment about most of their pilots tending to land "their side" of the plane first! Softbound, the 78-page publication is illustrated with photos and drawings, which, unfortunately, deserved better reproduction. Priced at $16.95 plus $2.50 postage, directly from ViP Publishers, Inc., P.O. Box 16103, Colorado Springs, CO 80935.

When contacting any of the mentioned firms, please mention that you read about them in *Model Builder!*

SIGN-OFF

George Townson, author of *Autogiro,* model builder and historian, explains that with advancing age he "only remembers the important things. . . whatever they were."

On the other hand, Herb Weiss is trying to simplify life by disposing of old stuff. As he put it: "You can't take it with you—but that's no excuse for leaving it in a mess." ***MB***

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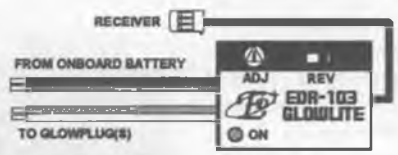

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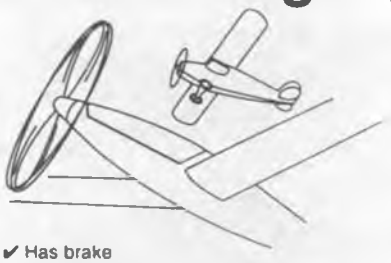

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FREE FLIGHT

BY BOB STALICK

• Joe Foster's Coupe
• 1/2A Nostalgia Engine Performance

For free flighters, September is one of the best months of all. It's usually calm, with only slight afternoon breezes. It's warm during the day but cools off pleasantly in the evening. Rains, if they come at all, are brief and act to keep the dust down. The fields are harvested, and you can fly on them to your heart's content. Usually, September ushers in the FAI semifinals or the World Champs, depending on the year. In our area, there's a contest practically every weekend of the month.

September. A great time of the year. A great time to get out and fly. It's time to fly before the weather turns into its winter sourness.

SEPTEMBER THREE-VIEW: JOE FOSTER'S COUPE

Those of us who have been around the FF scene for a while have a collective soft spot in our hearts for the versatile competitors in our ranks. Joe Foster is one such fellow. He has been on the U.S. FF teams, both indoor and outdoor, and has designed and built winning models in practically all categories. I still have a B Gas ship in my stable that was designed by Joe about 13 years ago.

Our friendly columnist shows off his newly completed Fortastrop, powered by a Wasp .049 for 1/2A Nostalgia competition.

Jim Martin, of Xenia, Ohio, took the .010 Microduster plans from the September 1993 issue of *Model Builder* and converted it to electric power, using an HY-70 drive setup from VL Products. Complete with batteries, it tips the scales at only 71 grams.

This month's model is his contest-winning Coupe d'Hiver. Simply called "Joe Foster's Coupe," it has geodetic wing and stabilizer construction, thin airfoils and a round cross-section balsa tube fuselage. It was a winner at the AMA Tri-Cities Nats and has won two 1st places at the U.S. FF Champs. According to the Oakland Cloudusters' newsletter:

"When Harlan Halsey was preparing the first Fowler Cup contests, one purpose was to smoke out the infamous 2-minute dead-air Coupe. We doubted its possibility in the cold air of January, February or March at 8 a.m. And indeed our results proved it. No one got five maxes—no one had that consistent two-minute Coupe, although some came close. Except Joe.

"So, with some casual attention to fuse length, he managed to put up two 3-minute flights and then inquired if it was necessary to wait until 9 a.m. to finish the series. I don't remember if he did. No matter. He had more than proven the possibility of a consistent minimum 2-minute design. So, here it is. Produced by Gordon Krueger and his magic CAD. One note: the drawings are proportional but not to exact scale. That's why the dimensions are included. If you want the exact

ERRATA

In the July '94 "Over The Counter" column we told you about the neat "Button" super-light DT device from Bob Munson of Wheels & Wings. We just got a call from Bob, who said he had given us the wrong address. The correct address for Wheels & Wings is 1908-C Tice Valley Rd., Box 221, Walnut Creek, CA 94595.

propeller blade outline, reduce the drawing to 89 percent. Wing and stabilizer ribs are full size."

SEPTEMBER MYSTERY MODEL

Back in the good old days, the designer of this month's stumper was featured just about every couple of months in the model mags. The first FAI Power model (as F1C was called in those days) that I ever built was designed by him. This month's Mystery Model, however, is not an FAI model; it's a Torp .035 powered, 150 square inch 1/2A ship that features a pod-and-boom fuselage and a two-wheel gear for R.O.G. takeoffs.

If you think you can identify the design, write it on a postcard or letter and send it to *Model Builder* (not to me). In a couple of months, they'll draw a name at random from among the correct entries, and the winner gets a free one-year subscription. Howzat for a real deal?

JUNE MYSTERY MODEL WINNER

Appearing as half-size plans in the April 1952 issue of Flying Models, *Arthur J. Novotny's ultra-simple "Wanderlust" might make a good choice for the new Early Nostalgia 1/2A event. It's a 150 square inch polyhedral design with a constant-chord wing and stab; the fuselage is a built-up box set on edge to form a diamond cross-section and, although not indicated anywhere on the drawing, is sheeted with 1/32 balsa. The winner of the free one-year* MB *sub is Jerry Knoblauch of Simsbury, Connecticut.*

1/2A NOSTALGIA ENGINE PERFORMANCE CHART

In *Model Builder's* earlier days, Free Flight columnist Tom Hutchinson featured a rundown of 1/2A Nostalgia engine performance, as conducted by Larry Conover. These rpm tests were conducted using the same fuel and 6x3 nylon Tornado or Top Flite props. In reprinting this chart, I've noted the engines that are acceptable for use in the Early Nostalgia event by an (*). Hutchinson and Conover also indicated the approximate wing area in square inches for these engines as well as the year the engine was introduced for sale.

As you can see, the quality of performance of .049 engines continued to improve during the decade. It's no wonder that the Hornet has become the engine of choice for 1/2A Nostalgia, with the Space Hopper a close second. Look for one of the better examples of these vintage engines at your nearby engine collector's swap meet.

1/2A EARLY NOSTALGIA ENGINE PERFORMANCE

Year	Engine	RPM	Wing Area (sq. in.)
1949	Torpedo .035	8,000	100
1949	Baby Spitfire .045*	10,000	150
1950	Torpedo .049*	12,000	175
1950	Atwood Wasp .049*	12,000	175
1951	OK Cub .049	11,000	165
1952	McCoy .049 Diesel	13,500	185
1952	Space Bug .049	14,000	200
1933	Atwood Signature/Shriek	14,500	220
1954	Thermal Hopper	13,300	250
1955-7	Thermal Hopper (2 bypass)	17,000+	270
1959	Space Hopper	18,000	320
1959	Holland Hornet .049	18,500	320

POLYSPAN TISSUE UPDATE

Two months ago, I talked about Polyspan tissue, available from Starline International. It's a polyester fiber tissue, applied like standard Japanese tissue; it's not an iron-on film. It has the appearance of a very light silkspan. It comes in an eggshell white color only, but takes analine dye easily. It does not watershrink, but two coats of dope will give it some shrinkage and will completely seal the surface.

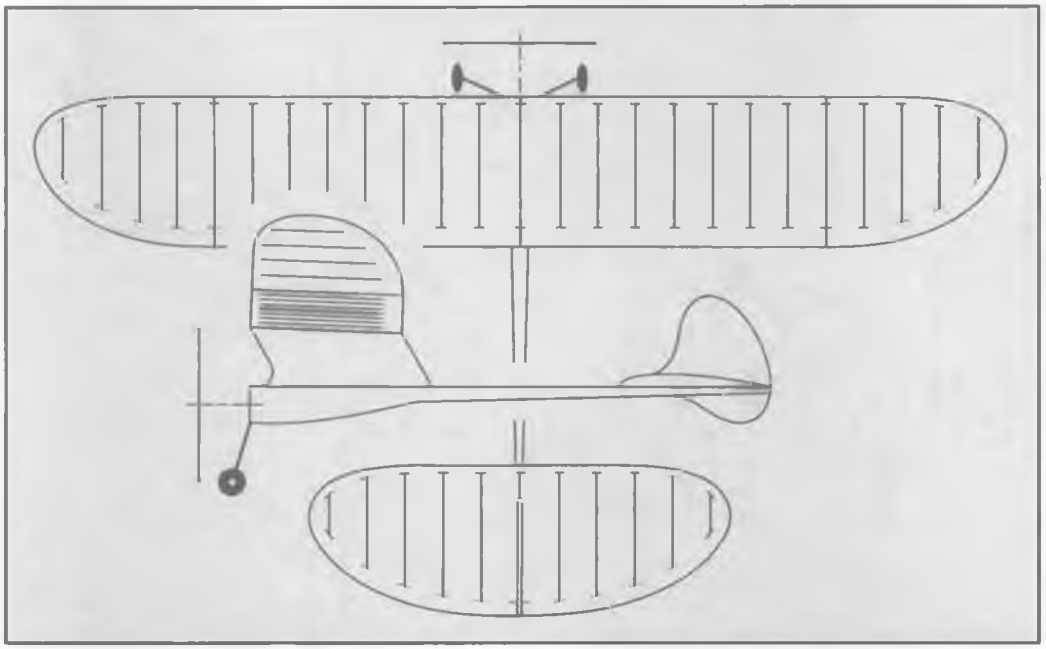
I've had a chance to test this tissue and find it to be very tough stuff—more so than silk. Thump on it—you'll probably damage the structure before you puncture the tissue. It does weigh more than tissue, but not too much more. My electronic gram scale shows the following weights per square foot (unless noted, all samples are white in color):

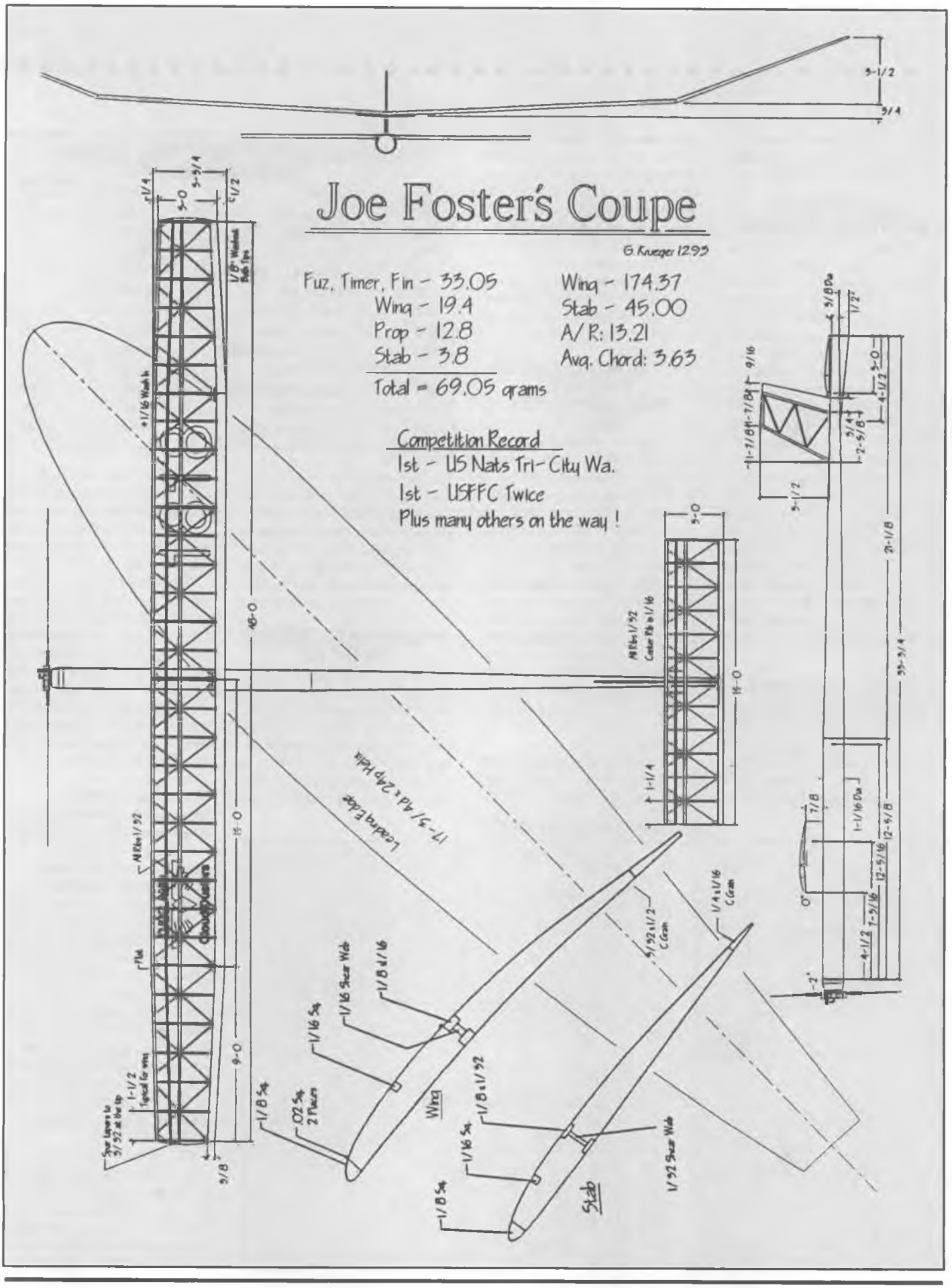
Condenser paper—.58 gram.
Prewar Japanese superline—.62 gram.
Postwar Japanese tissue—1.2 grams.
Domestic Tissue—1.3 grams.
Esaki silk (orange)—1.41 grams.
Starline Polyspan—2.3 grams.

The weights show Polyspan to be heavier than the others, but remember that it will take only two coats of dope to finish. In contrast, the other tissues (excluding condenser paper) will typically take four or five coats. The domestic tissue, which has a shiny surface on one side, can be completely filled in two or three coats. Silk, of course, seems to take me about six or seven coats to completely fill.

For strength, waterproofing and reasonably light weight, Polyspan seems like a good choice. A 12-foot roll can be yours for $15 plus postage. Contact Starline International, 6146 E. Cactus Wren Rd.,

SEPTEMBER MYSTERY MODEL




Joe Foster's Coupe
G. Krueger 1293
Fuz, Timer, Fin - 33.05
Wing - 19.4
Prop - 12.8
Stab - 3.8
Total = 69.05 grams
Wing - 174.37
Stab - 45.00
A/R: 13.21
Avg. Chord: 3.63
Competition Record
1st - US Nats Tri-City Wa.
1st - USFFC Twice
Plus many others on the way !
Wing
Stab

Scottsdale, AZ 85253.

ADDRESS CHANGE

Did you know that anyone wishing to fly at California's famous Lost Hills site must be a member of the Lost Hills Free Flight Model Airfield Association? The new addresses for the organization are as follows: For membership info or applications, write to Lost Hills Association Membership, 4737 Boyar Ave., Long Beach, CA 90807-1238. For general info and reservations, contact C.J. Jordan, c/o LHFFMAA, 18122 Theodora Dr., Tustin, CA 92680; (714) 832-3138.

NFFS PLANSBOOK

By the time you read this, the new NFFS FAI World Champs Plansbook should be ready for you. It features approximately 300 pages of three-views, photographs and information about most of the World Champs competitors in F1A, F1B and F1C. Mike Achterberg is doing the editing work for this historic document. In 1993 the USA hosted 99 fliers in F1A, 90 in F1B, and 57 in F1C—so the details will be plenty. For price and ordering information, contact Fred Terzian, 4858 Moorpark Ave., San Jose, CA 93129.

DOMEDUSTER PUBLICATIONS

If you are new to FF scale modeling or still wondering how to make that new ship look like a miniature of the real thing, Stan Fink's new 16-page booklet, *Dress Up That Scale Ship*, is the publication for you. It's filled with Stan's hints and tips about making that scale ship look and fly well. Included are tips about tissue collage, tissue dyeing, art markers, solvent transfer, brush painting, using the copy machine, border tape and other tips. Order your copy from Stan Fink, 1810 Pine St., Philadelphia, PA 19103. Cost is $10 postpaid.

UPDATED B-Y&O PROPS

About eight months ago, I noted the reintroduction of the classic Y&O propellers by fellow Willamette Modelers Club member Clarence Bull. Clarence's prop shop has expanded since last year. In fact, he has had to add an employee to the payroll to keep up with the orders.

If you haven't seen one of Clarence's gems, you are missing a real treat. These are lovingly produced by modelers who care about the product, what it looks and feels like, and how well it works. Demand has far outstripped their ability to produce the numbers of props on order. If you're one who has had an order on the books for a while, be patient. Your order will be filled in the sequence it arrived, and you won't be sorry for the wait.

If you want to place an order or request a price list, you can do so by writing B-Y&O Props, P.O. Box 492, Harrisburg, OR 97446.

In its initial trimming stages at a recent Stratobats contest in Washington was this Lenderman-designed Coupe pictured here with builder/flier John Kamla.

NEW CATALOG FROM KEN SYKORA

Another source of wonderful old plans and hard-to-find free flight supplies is from Old Timer Model Supply. Proprietor Ken Sykora has produced the 1994 catalog with the usual supply of goodies, plus some new additions. I enjoy the little quips and quotes that Ken includes with each catalog, such as: "I never met a modeler I didn't like... but some took a lot more work than others."

To get the latest catalog, send $2 to Old Timer Model Supply, P.O. Box 7334, Van Nuys, CA 91409. ***MB***

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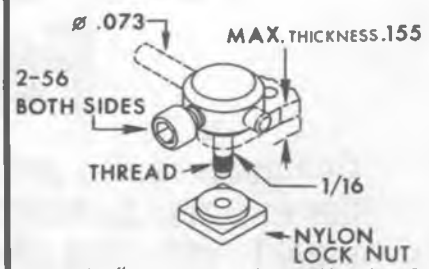
NEW

2-56 ROD CHUCK



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BY ELOY MAREZ

The Quasar RC System From Airtronics

Computer radios are not just for competition fliers—any weekend sport flier can also benefit from the extra precision and much easier and faster model setup that such systems provide. With the Quasar, Airtronics has broken new ground in terms of ease of programming.

The Airtronics Quasar is a mid-priced, microprocessor-enhanced RC system for sport fliers not primarily involved in competition aerobatics—that is, it's not a "push a button, do a 10-point maneuver" type of radio. It does, however, include all of the modern electronic advances useful to the sport and scale flier, including a variety of mixing functions and the degree-by-degree, visibly displayed control adjustments that those who have experienced will never be without again.

The Quasar is a six-channel system, available in both airplane and helicopter versions, PPM/FM, modes one or two, and on all legal 72, 50 and 53 MHz channels. Both the transmitter and receiver are designed to meet all FCC and AMA criteria for narrow-band operation, a fact I personally confirmed by spectrum analyzer testing.

Many otherwise knowledgeable fliers seem to be reluctant to take a close look at the many advantages of computer radios; they fear getting in over their heads with something they're not experienced with. One definitely does *not* have to be a computer hacker to learn to use the Quasar. As a test of its user-friendliness, I tackled the system cold turkey, without opening the instruction book at all. Even though I don't have a lot of experience with computer radios, I had the Quasar under complete control in just half an hour.

A major factor contributing to the Quasar's ease of programming is that the operational features of the transmitter, the markings, and the very important 43-page instruction manual are all obviously the work of highly experienced RC fliers thoroughly conversant with the English language. The results are a near-perfect blend of transmitter and aeronautics terminology. We can all understand references to elevators, flaps and throttles, right? And we can learn, without the need for a training video, the use and implication of terms like model-select, and the actions of buttons marked yes/no, increase/decrease, etc. Good clear terminology, without any gobbledygook or strangely translated English.

The bottom line is that even if you have absolutely no experience with a computer transmitter, the Quasar's instruction manual will walk you, step by step, through all the procedures necessary to program the system exactly as you—and your airplane—require. And you'll understand it all!

The transmitter as furnished with the airplane version of the Quasar radio; the helicopter version looks basically the same but has different switch and knob placement at the top, as well as completely different programming.

The Quasar transmitter is a two-stick unit, well proportioned and balanced, and drops comfortably into your hands. It has a solid feel to it, with all switches, knobs, trims and the all-important gimbals operating crisply and smoothly. Both stick length and tension are adjustable. Unlike some

other systems on the market, this transmitter does not include programming for both airplanes and helicopters; they are separate systems, and since James Wang is sure to have something to say about the Quasar heli system in one of his upcoming "Chopper Chatter" columns, we'll limit our discussion to the airplane version.

All programmable transmitter functions are sharply displayed on an 11/16x2-3/4 inch Liquid Crystal Display screen. All the required information is entered with five adjacent, clearly marked pushbuttons, and once everything is adjusted as desired, all programming functions can be stopped with a top-mounted toggle switch marked "Key Lock." It would be a good idea to add the positioning of this switch to your before-takeoff checklist, although even if left on, nothing happens unless you also push the programming buttons. Doing so while flying, with the transmitter held in both hands, is a virtual impossibility.

One definitely does* not *have to be a computer hacker to learn to use the Quasar.

Six channels, the four main ones of course being on the sticks themselves, and equipped with finely ratcheted trims. In addition, a feature called "Sub-Trim" allows you to finely adjust the servo centering (about 10 degrees each way) on all channels except throttle. Channel 5 is a top-mounted retract gear switch; channel 6, normally used for flaps, is a knob on the upper left front panel. Additional features include:

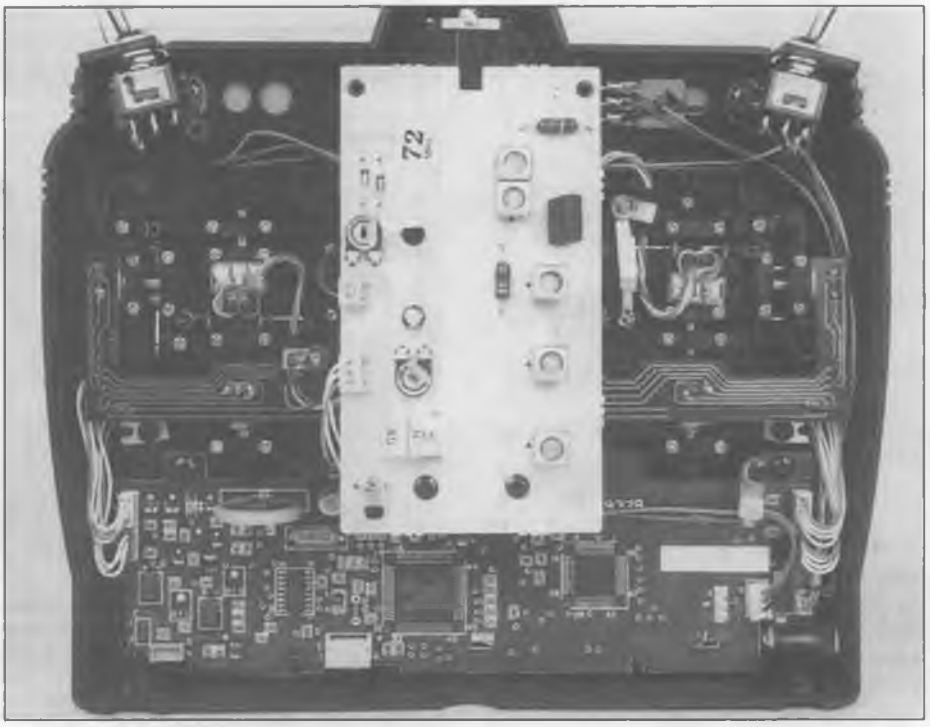
- Elevator-to-flap mixing.
- Flap-to-elevator mixing.
- Aileron-to-rudder mixing.
- Spoilerons.
- Flaperons.
- Aileron differential.
- Throttle-to-rudder coupling.
- Throttle-to-elevator coupling.

All of the above can be adjusted individually to any degree desired, and can be programmed out completely if not wanted.

Memory for three different models is available; that is, you can program the transmitter in three totally different manners as required by three airplanes, and restore all settings at the push of a couple of buttons. Dual rates are available on the aileron and elevator channels. Servo reverse and end-point adjustment are provided on all channels, the latter being adjustable 1 degree at a time. If you're still changing holes on the control horns and adjusting clevises, you don't know what you're missing!

For power, the Quasar transmitter depends on the usual eight-cell pack. I was pleased to find that the cells used are 600-

■ **ABOVE: All pertinent programming information is readily visible on this large LCD display, all entries being made with five plainly marked and understandably labeled pushbuttons.**
■ **LEFT: Transmitter battery condition is clearly displayed on this multi-colored expanded scale voltmeter. A glance at such instruments before every flight is a good habit to form.**
■ **BELOW: The insides of the Quasar transmitter shows the use of modern surface mount components and logical, easy-to-service design. The gimbals are readily accessible for stick tension adjustments.**



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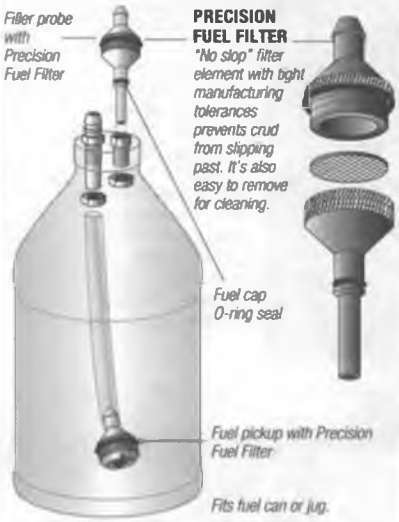

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Furnished with the Quasar system is Airtronics' well-proven 92765 receiver (right), a dual-conversion, narrow-band FM unit, pictured here with the Sanyo 600-mAH airborne NiCd pack for size comparison.

mAH Sanyos, and that the pack connects to the transmitter via a normal Airtronics gold-plated plug. Battery condition is indicated on a three-color analog ESV (Expanded Scale Voltmeter). Those who like to keep track of the condition of their batteries will be happy to know that there is no diode in the charging circuit; connections to your Ace Digipace or other battery capacity tester can be made directly through the charge plug (center is positive). A Sanyo 600-mAH four-cell pack is furnished for the airborne system. A dual-LED, wall-mounted, overnight charger is also supplied.

The type of microprocessor used in the Quasar requires a backup battery to maintain the memory when the main NiCd pack is removed or totally depleted. A small lithium battery, which has a useful life of some five years in this application, is used for this purpose. Changing it is normally a job for the service center. I would recommend it be done during at the last non-flying season prior to the passing of five years.

The receiver furnished with the Quasar needs no introduction to those familiar with Airtronics equipment. It's the 92765 dual conversion, narrow band FM unit, which measures 2.7x1.36x0.85 inches and weighs only 2 ounces. It incorporates state-of-the-art design and assembly techniques for lightweight electronics, such as a thick, double-sided, plated through-hole epoxy component board and surface mount components. It meets and exceeds all established criteria, and I know it to be highly successful in the crowded and dirty environment at our well-known Mile Square (Southern California) flying field.

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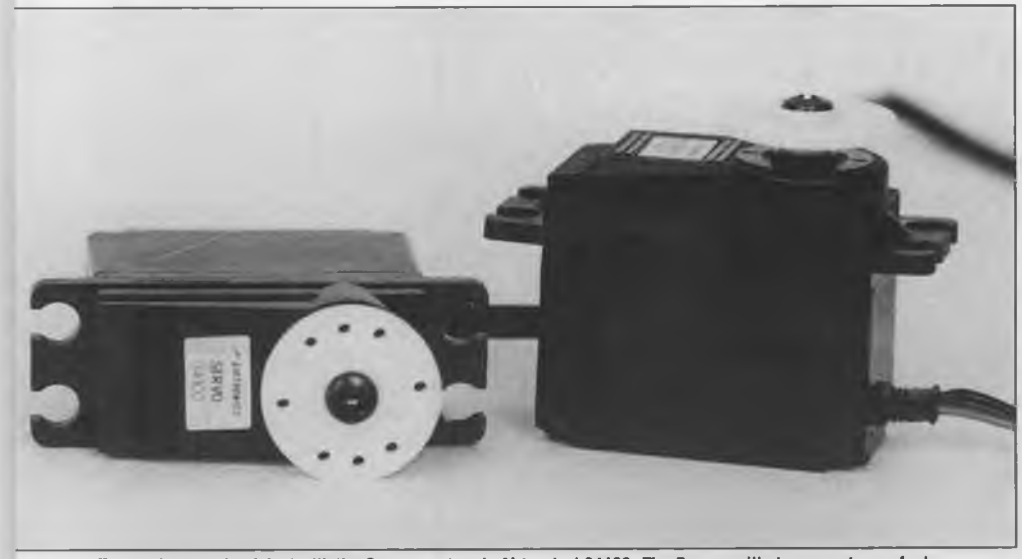

The basic servo furnished with the Quasar system is Airtronics' 94102. The Quasar will also accept any of a large number of available specialized servos and electronic speed controls.

will want to take a second look at the Airtronics 92745 micro receiver, which seems to be a compressed version of the 92765. It's a four-channel FM unit which specs out at 2.25x0.96x0.82 inches and only 1 ounce.

The servos supplied with the Quasar are 94102s, the workhorse of Airtronics' servo line. They incorporate well-designed and assembled electronics, heavy gear trains and indirect feedback pot drives. The 94102 measures 1.54x0.79x1.42 inches, weighs 1.59 ounces, and is rated at 50 ounce-inches of torque. Airtronics also makes available a wide variety of servos for more specialized applications, including 0.57 ounce micros, coreless for competition aircraft, and a powerful 135 ounce-inch unit for giant scale types. All are plug-in compatible with the Quasar, as are a variety of Airtronics electronic speed controls for electric powered flight.

SUMMARY

This is an extremely well-thought-out and manufactured unit which I can recommend without reservation, especially to those who have been reluctant to step up to a "computer" radio. Equally important, it is backed up by a company that is without peer in the customer service department. Joe Blow Modeler can actually call Airtronics and speak directly with an experienced flier, or even a technician if need be. Try Airtronics—and a Quasar—you'll like them both! ***MB***

Perched atop the standard 92765 receiver is Airtronics' smaller and lighter 92745 four-channel FM unit, also dual conversion and narrow band, for gliders and small airplanes.

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6 x 2	1	1.59
6.3 X 4		3.95
6.5 X 2.9	2	3.95
6.5 X 3.7	2	3.95
6.5 X 5.0	3	3.95
6.5 X 5.5	3	3.95
6.5 X 6.0	3	3.95
6.5 X 6.5	3	3.95
7 x 3	15	1.59
7 X 4	15	1.59
7 X 5		1.59
7 X 6		1.59
7 X 7		1.59
7 X 8		1.59
7 X 9		1.59
7 X 10		1.59
7.8 X 4	14	3.95
7.8 X 6	6	3.95
7.8 X 7	6	3.95
8 X 7.3	5	3.95
8 X 4	14	1.79
8 X 5		1.79
8 X 6		1.79
8 X 7		1.79
8 X 8		1.79
8 X 9		1.79
8 X 10		1.79
9 X 4	16	1.99
9 X 5	16	1.99
9 X 6		1.99
9 X 7		1.99
9 X 8		1.99
9 X 9		1.99
9 X 10		1.99
9.25 X 5.0	4	3.95
9.25 X 5.25	4	3.95
9.25 X 5.5	4	3.95
9.25 X 5.75	4	3.95
9.25 X 6.0	4	3.95
9.5 X 6.5N	5	3.95
9.5 X 7.0N	5	3.95
9.5 X 7.5N	5	3.95
9.5 X 8.0N	5	3.95
9.5 X 8.5N	5	3.95
9 X 6.5	5	3.95
9 X 7.5	5	3.95
9 X 8.5	5	3.95
9.5 X 4.5	11	2.29
10 X 3		2.29
10 x 4		2.29
10 X 5		2.29
10 X 6		2.29
10 X 7		2.29
10 X 8		2.29
10 X 9		2.29
10 X 10		2.29
10.5 X 4.5	11	3.95
11 X 3		2.49
11 X 4		2.49
11 X 5		2.49
11 X 6		2.49
11 X 7		2.49
11 X 8		2.49
11 X 9		2.49
12 X 6		2.89
12 X 7		2.89
12 X 8		2.89
11 X 10	7	7.95
11 X 11	7	7.95
11 X 12	7	7.95
11 X 12W	7	7.95
11 X 13	7	7.95
11 X 14	7	7.95
11.5 X 4	8	2.89
12.25 X 3.75	8	3.49
12 X 9	7	7.95
12 X 9W	7	7.95
12 X 10	7	7.95
12 X 10W	7	7.95
12 X 11	7	7.95
12 X 11N	7	7.95
12 X 11.5	7	7.95
12 X 12	7	7.95
12 X 12.5	7	7.95
12 X 12N	7	7.95
12 X 13	7	7.95
12 X 13N	7	7.95
12 X 14	7	7.95
12.5 X 9	7	7.95
12.5 X 10	7	7.95
12.5 X 11	7	7.95
12.5 X 11.5	7	7.95
12.5 X 12	7	7.95
12.5 X 12.5	7	7.95
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13 X 7		4.25
13 X 8		4.25
13 X 9	7	7.95
13 X 10	7	7.95
13 X 11	7	7.95
13 X 13N	9	7.95
13 X 13.5N	9	7.95
13.5 X 9	7	12.95
13.5 X 10	7	12.95
13.5 X 11.5N	7	12.95
13.5 X 12.5	10	12.95
13.5 X 13.3	10	12.95
13.5 X 13.5	10	12.95
13.5 X 14	10	12.95
13.5 X 14W	10	12.95
14 X 5N		12.95
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14 X 8		12.95
14 X 10		12.95
14 X 12		12.95
14 X 12N	10	12.95
14 X 13	10	12.95
14 X 13N	10	12.95
14 X 13.5	10	12.95
14 X 13.5N	10	12.95
14 X 14	10	12.95
14 X 14N	10	12.95
14.4 X 10.5	10	12.95
14.4 X 12	10	12.95
14.4 X 13	10	12.95
14.5 X 14N	10	12.95
14.5 X 14.5N	10	12.95
15 X 8	10	12.95
15 X 10	10	12.95
15 X 11	10	12.95
15 X 12	10	12.95
15 X 13N	10	12.95
15 X 14N		12.95
15.5 X 13N		12.95
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20 X 18		25.00
20 X 20		25.00
21 X 12		25.00
22 X 8		31.00
22 X 10	13	31.00
22 X 12	13	31.00
22 X 14		31.00
22 X 16		31.00
22 X 18		31.00
22 X 20		31.00
22 X 22		31.00
23 X 18		38.00
23 X 20		38.00
23 X 22		38.00
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A Slope Soarer's Paradise:

Mount Greylock, Massachusetts

■ LEFT: Rudy Coletti and his Airtronics Olympic II, the Veteran's Memorial stone tower in the background. ■ RIGHT: Rudy Coletti watches as our author launches a House of Balsa Two by Four from a high-start at the Rockwell Road visitor center. After dropping the line, Dave will push out to the row of trees just past the road. On windy days, the tree line gives sustained ridge lift. On hot days with light wind, the ridge lift boosts the glider into thermal lift.

Jim Harrigan tests the lift—or is he just pausing to take in that breathtaking scenery?—before launching his Goldberg Gentle Lady.

New England is blessed with some of the best glider flying sites in the country. Mt. Greylock is the tallest peak in Massachusetts and offers two excellent sites, for intermediate to advanced fliers.

The author about to launch his Bob Martin Bobcat. Onlookers are Boy Scouts hiking on the Appalachian Trail, which traverses the Mount Greylock peak.

BY DAVE GARWOOD • PHOTOS BY THE AUTHOR AND JIM HARRIGAN

Mount Greylock

Conventional wisdom suggests that slope soarers don't fly much in the Northeast because the tree cover makes flying sites tough to find. This is often true, but it really just makes finding sites a bit more challenging. Once you've had a chance to fly a glider in the picture postcard scenery of the mountains in New England, you'll agree that searching for suitable flying areas is worth the effort. For a start, consider a trip to Mount Greylock, in the northwestern corner of Massachusetts.

All slope sites have some kind of a view, but this one is better than average—at 3,500 feet MSL, Mount Greylock is the highest point in Massachusetts, and from the top you can see three states. It has soarable

Looking south from the stone tower shows the grass landing area available when the summit is not crowded with visitors.

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slopes facing two compass directions, grass landing areas, a restaurant, comfort facilities, and alternative activities if you make the trip and find unflyable conditions. The flying site is on public land maintained as a recreational facility by the Department of Environmental Management, so legal access to the site is not a problem. RC glider fliers are subject to park regulations, of course. Access is easy; you can drive to the top on a paved road.

If you get tired of flying and need refreshment, try Bascom Lodge, run by the Appalachian Mountain Club. Located on the summit, the Lodge has a restaurant with a view, and overnight accommodations.

If your receiver batteries give out before you do, there are alternative activities. Hikers can enjoy the Appalachian Trail, passing through the park on its 2,400-mile route from Maine to Georgia. An overnight parking area is available for car camping and a departure point for backpacking trips. On U.S. Route 2 between North Adams and Williamstown is a full-scale gliderport. Orange, 45 miles to the east, is a sport parachuting center.

THE FLYING SITES

With wind from the south or southeast, lift for launching and flying is not a problem. The primary slope is gradual enough to allow safe footing and has no nearby large trees, so it offers good visibility of the soaring airspace.

The summit features a stone monument surrounded by paved walks and mowed grass. In addition to the stone tower, there's a TV broadcast tower and an amateur radio relay tower, so it's essential to range check your radio before flying.

You can take your choice of landing on the slope face or on top. The grass at the summit has enough cleared space to provide adequate landing area, but is surrounded by trees on three sides. A safe landing here requires some planning and skill. If you're flying a ship with spoilers or other glidepath control, you'll have plenty of opportunity to use them.

The park rangers allow sailplane and motorglider flying from the summit, when it's not crowded with visitors. When the summit is populated or the wind is from the west, a second flying site is available adjacent to the Visitor Center on Rockwell Road, overlooking a valley to the west. Check in with the ranger in the Visitor Center before launching.

This location requires a high-start launch and is a perfect place to use a "short field" launching device. The launch must gain enough altitude to cross a road and push out to a treeline about 200 feet beyond the high-start stake. You'll be flying over grass and cultivated fields, so there's less danger of losing a model or crashing on landing than on the mountaintop, but you do have to reach the treeline to get an initial boost of ridge lift.

You can fly in ridge lift over the treeline

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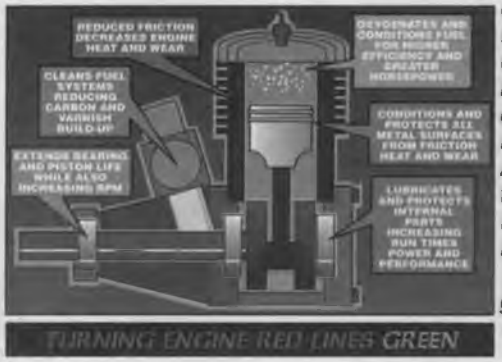

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Ron Kelly and Jim Harrigan rest in the shade by the Rockwell Road Visitor's Center, the alternative flying site used when the summit is crowded or the wind is from the west.

while waiting for thermals to drift through. The combination of both types of lift results in some very long and high flights.

The two-acre mowed field for launching and landing has treelines on two sides. It's not a training site, but it *is* a good landing spot if you have experience with your sailplane. There's a big tree to sit under while flying. This is relaxed glider flying!

HOW TO GET THERE

Mount Greylock is located 35 miles from Albany, 130 miles from Boston, 115 miles from Concord, 70 miles from Hartford, 125 miles from Montpelier, and 160 miles from New York City.

Mount Greylock Reservation is open for motor vehicles from late May until snows close the access roads. It's open to hikers all year long. You may wish to call Bascom Lodge (413-743-1591) or the Visitor Center (413-499-4262) to confirm that the park is open to motor vehicle traffic.

FINAL THOUGHTS AND REMINDERS

Dress warm and windproof. Conditions are more severe in the mountains than on the flatlands. Bring different size airplanes to handle different wind conditions. Always do a range check before launching, if you fly from the top. The Ham radio repeaters can swamp our radios.

This is *not* a training site. But if you're proficient at launching, flying and landing on the slope, and you like scenery, you'll smile when you're at Mount Greylock! **MB**

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Northwest Hobby Technologies recently purchased all rights for these Sport Scale kits, and more from D & R Aircraft Mfg. We have updated the kits to make the planes light and more durable. The kits come complete with the following: All balsa wood needed, bubble canopy, fiberglass cowling, fiberglass for coating the wing joints, wire landing gear, all hardware, pre-cut foam wings, fuselage and tail structure, and step-by-step instructions on video makes it easy. NO MODELING EXPERIENCE NEEDED. Even a novice can ensure fantastic results by closely following the video. It is estimated that it will take 40 hours for a novice to assemble and less for the experienced.

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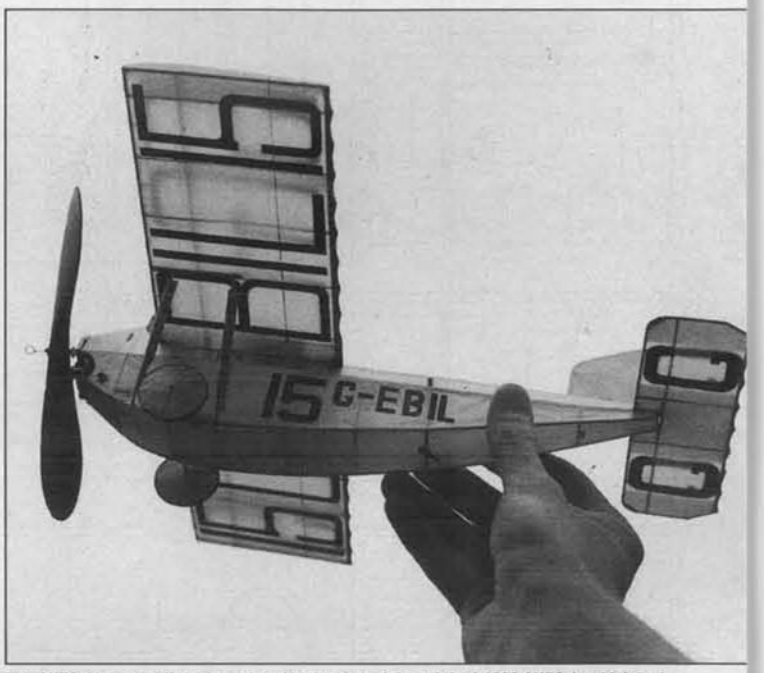
THE ANEC 1A LYMPNE RACER

Some of the most fascinating minimum-power aircraft ever designed came as a result of the lightplane trials at Lympne, England in the 1920s. The ANEC series has long been one of our personal favorites, and makes an excellent subject for Peanut Scale.

BY TOM NALLEN II



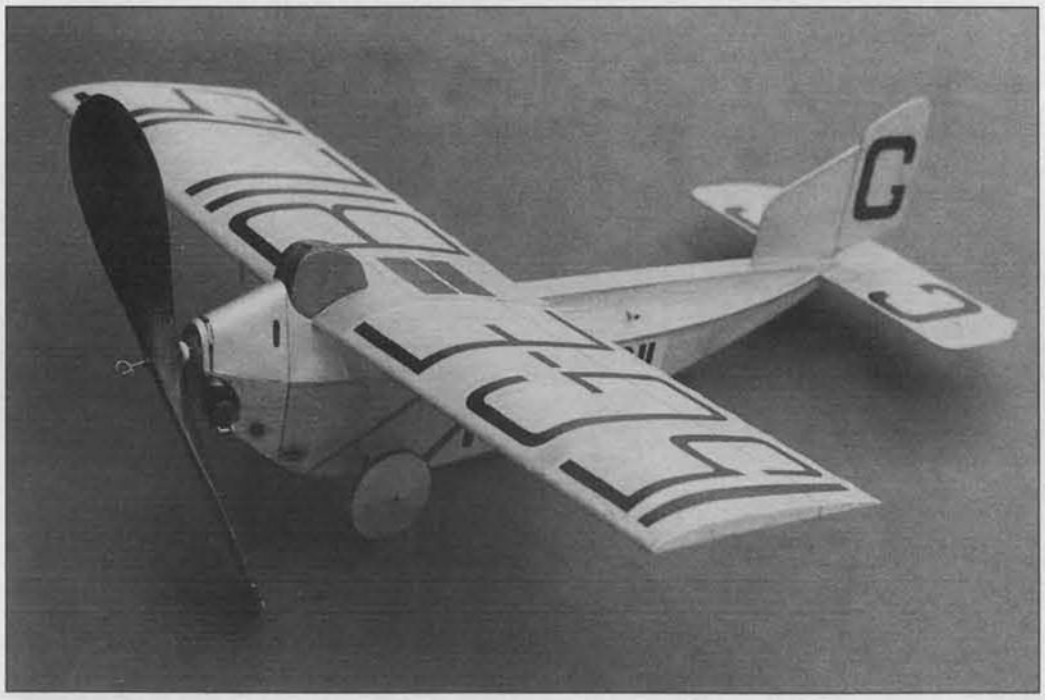
The ANEC 1a was a clipped-wing racing version of the original 1923 ANEC 1, which had a much longer wing and was little more than a powered glider. More information on the ANECs as well as many of the other Lympne entries can be found in Richard Riding's excellent book, *Ultralights, The Early British Classics*, available through Hannan's Runway, P.O. Box 210, Magalia, CA 95954.

A clattering, high-pitched whine shatters the early morning calm. Suddenly, through the low fog bursts an incredibly small and squat aeroplane, looking like an overgrown buggy which, because it's sprouted wings, thinks it can fly!

Gathering speed and bouncing on its large makeshift wheels, the little plane zips by. A shadowy figure works frantically beneath the broad wing to get the craft unstuck.

Bouncing off one final rise, the pilot hauls the snarling beast off the ground. She clears the trees in a shallow climb, her pilot glancing back over his shoulder and grinning broadly.

The setting for this imaginary vignette is the 1925 lightplane trials at Lympne, England. The odd little aeroplane is the ANEC 1a, the subject of this article. Its predecessor, the ANEC 1, was built in 1923 by the Air Navigation and Engineering Company to compete at Lympne that year. With a wingspan of 32 feet and powered by an inverted 696cc



With its unusual fuselage contours and prominent markings, the ANEC 1a makes an interesting and challenging subject for those with a couple of simpler Peanuts to their credit. It's also a fine flier; this one was lost O.O.S. at last year's FAC Nats. Would also make a fine subject for CO_2 power using one of the tiny Brown or Gasparin motors.

1/32 SQUARE & SHEET STABILIZER

1/32 SHEET TIP RIB

1/16 SHEET (HARD)

1/32 SHEET

1/16 SHEET NOSEBLOCK

1/4 SHEET PLUG

1/16 BRASS BUSHING

1/20 SHEET FILL

STRUT LOCATION

BLACK HATCH WINDOWS W/SILVER FRAME

1/32 x 3/32 STRUT MOUNT

1/16 x 1/8 LEADING & TRAILING EDGE

WHITE FIELD

WHITE FIELD

ALL MARKINGS TOP & BOTTOM

CONSTANT RADIUS

TYP. SECTION

1/32 SHEET

OPTIONAL LIGHTENING HOLES

1/32 SHEET SPAR

REAR STRUT

7/32 DIHEDRAL EACH TIP

1/20 ROUND WING STRUT

PAPER FAIRINGS

1/32 SQUARE FIN & RUDDER

NO WHITE FIELD ON RUDDER

HOLLOWED FOAM FUEL TANK (BRASS)

BOND PAPER TOP & SIDE COWLING PANELS

BALSA GAS CAP TISSUE STRAP

CUT OUT AFTER ASSY.

COLOR SCHEME: OVERALL SILVER W/BLACK MARKINGS ON WHITE FIELDS

REFERENCES: "ULTRALIGHTS" (RIDING) P#3
AIRCRAFT ILLUST. OCT '69 P392

BRITISH ANZANI

1/16 SHEET

AXLE: 2 1/16 x 1/32 LAMS. W/.015 WIRE SANDWICH

FOAM WHEELS W/ PAPER DISCS

1/20 SHEET

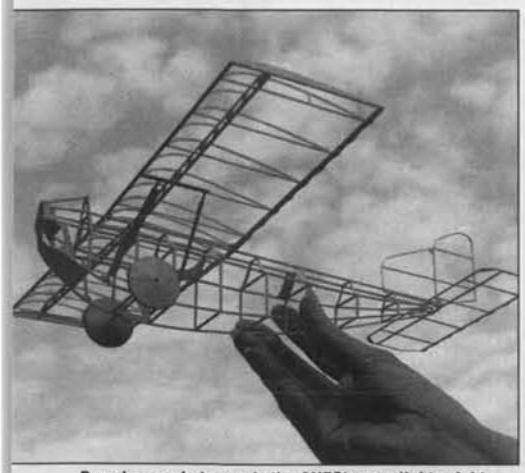
FUSELAGE ALL 1/20 SQUARE

G-EBIL

A LYMPNE RACER!

ANEC 1a

T.E. NALLEN II 1992



Bare-bones shot reveals the ANEC's very lightweight structure. With that fairly short nose moment, the tail end *must* be built light to avoid having to add nose weight.

Blackburne V-twin, it won the altitude prize with a flight to 14,400 feet and also tied for the best distance flown on a gallon of fuel—87.5 miles.

In 1925, with its wings clipped to 18 feet and fitted with a 1,100cc British Anzani motor for racing, the now ungainly little ship was rechristened the ANEC 1a. She was again piloted at Lympne by the indomitable Jimmy James, who won the speed prize by averaging 83.7 mph over the 50 km course—and yes, he did have problems getting the ship off and back onto the ground!

I thought the ANEC 1a would make an interesting and competitive Peanut model. My only regret is that I enjoyed her for just a short time. In her second contest, the 1993 FAC Nats in Geneseo, she was lost O.O.S., narrowly missing a 1st place finish.

CONSTRUCTION

First wet-form the fuselage longerons using a cardboard template to help maintain the fuselage shape, then build the fuselage sides in the conventional manner. This ship has a short nose moment, so use light wood in the aft end right from the start. Be sure to add the 1/20 square uprights at the very nose, just forward of the cutout for the dummy engine cylinders. These uprights will be cut away after the fuselage has been completed.

Assemble the fuselage box; make sure everything is square when viewed from all angles. Add the top and bottom sheet fill to the nose and tailskid area. Cement the 1/16 sheet cowling face to the nose crosspieces. Install the two nose formers. The noseplug former should be of hard balsa to withstand constant removal and replacement of the noseblock. Notch the formers and add the three stringers.

The fuselage turtledeck is made by first assembling the 1/20 square turtledeck top frame over the plan. The front of this frame is cemented to the rear of the second nose former; the rear is cemented to the upper longeron ends at the fuselage tail post. The sliced 1/20 sheet side formers are cut to size and cemented in place side-to-side, front to rear. I inserted a temporary thin foam profile between the turtledeck top frame and the fuselage box to maintain alignment as the side formers were installed.

Note that all of the side formers have the same constant radius arc. Cut out all of the formers at once, then trim to fit and cement in place. Cement the cockpit sides in place. Complete the turtledeck by carving the hard balsa rear motor peg support to a concave shape; cement this in place and drill it for the 3/32 aluminum tube motor peg.

Complete the fuselage by cutting away the front uprights, the forward ends of the lower longerons and the nose bottom sheet fill to make the openings for the dummy cylinders. Open up the landing gear support for the faired axle. Make the noseblock as shown, drill the assembly with a few degrees of downthrust and insert the 1/16 brass tube bushing. Bring the noseblock to a snug fit and finish shaping. The entire fuselage can now be fine-sanded and set aside for covering.

I designed the wing with a thick airfoil section to retain this characteristic feature of the original. Sliced rib construction is employed to maintain lightness with the bulky structure. Half-ribs are also used to help maintain the deep airfoil section. I used 1/32 balsa for the sliced ribs but would probably use 1/20 if I did it again, as the thin sheet balsa tends to distort across that broad chord wing—especially if you plan to shrink the tissue covering much! The 1/32 sheet spar is deep and I opted for lightening holes to minimize unnecessary weight.

These items noted, wing construction is pretty straightforward. Start by selecting stiff and straight lengths of 1/16x1/8 balsa for the leading and trailing edges; pin these down and cement the rib base strips in place. Cut out the spars and cement them in place, on edge, over the base strips. The inner edges of the outer wing spars are cut at an angle to mate with the short center spar section when the wing panels are blocked up for dihedral. Next, cement the sliced ribs and half-ribs in place, making sure to cement where the rib contacts the spar. Cement the tip ribs in place.

After the wing has been assembled flat on the building board, cut the dihedral breaks in the leading and trailing edges and block up each tip 7/32 inch; ensure that the spar sections mate well. Cement the dihedral breaks and gusset the joints. After the cement has hardened, install the strut mounts. Shape the leading and trailing edges and fine-sand the entire structure.

The tail surfaces are straightforward, but lightly constructed to avoid the need for unnecessary noseweight. The fin and rudder outlines are wet-formed around a light cardboard template. Gussets are added to strengthen key joints—don't leave these out. When construction is completed, carefully fine-sand the components and set aside for covering.

COVERING

Like many early British lightplanes, the ANEC was silver overall with black registration and racing numbers on white fields. Despite the availability of silver tissue, I chose to cover with white tissue, mask the registration and racing numeral fields, then airbrush the entire airframe with a coat of thinned Floquil silver paint. With all of that signage, very little paint will be needed! After the color is applied, remove the masks and carefully attach the black tissue markings with very thin lacquer or a spray adhesive. A final airbrushed coat of thin lacquer

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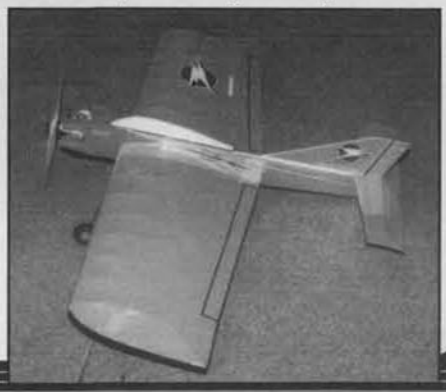

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will seal the covering adequately.

A few notes regarding covering. First, there's no need to cover the fuselage where the bond paper cowling panels will attach. Also, remember to adhere the tissue well to the concave turtledeck formers so that the covering won't pull away when shrunk. As for shrinking, I recommend that you not shrink the lightly built tail surfaces. Work to get as taut a covering job as possible without shrinking and use thinned lacquer to seal the tissue. Over time, the tissue will tighten somewhat with much less warping than if the tissue were water shrunk and doped.

ASSEMBLY

Fashion the landing gear axle out of two laminations of 1/32x1/16 balsa with .015 music wire sandwiched between. The wheels are foam discs with silver paper cones glued to each side. Note that there is no tire; the real ANEC simply had a leather strip tacked around the wheel! Use black tissue or silkspan to simulate this. Next, cut the cowling panels from light bond paper. Trim these panels to fit, paint silver and cement to the fuselage as shown.

The wing is cemented directly to the top of the fuselage turtledeck. Note that the stabilizer is designed such that the decalage is adjustable to optimize flight trim. For the first few flights, the stabilizer is cemented securely at the tail post only. the leading edges being tack-glued to the fuselage sides. Stabilizer incidence can then be adjusted in small increments by moving the leading edges up or down. Finish assembling your model by making and installing the short wing struts.

DETAILING

A realistic dummy engine can be made from paper tube or soda straw sections wrapped with thread and painted black; the cylinders are inserted in the cowling openings and cemented to the sheet fill between the upper longerons. The distinctive gravity feed fuel tank is fashioned from foam, hollowed and covered with tissue using thinned white glue. Paint the tank a brass color and mount it atop the wing with white glue. Don't forget the brown tissue strap and scrap balsa gas cap.

Our pilot needs a way to get in and out of this crate, so let's simulate the cockpit hatch using black tissue windows in a silver bond paper frame. Mount this hatch to the top of the wing using a spray adhesive. Now finish your model by inking the control surface and cowling panel outlines with a light straightedge and a fine-point Sharpie pen.

FLYING

My ANEC flew well with a 12-inch loop of 2mm FAI Tan rubber turning a 6-inch carved balsa prop. Flight pattern was right/right. The model balanced at the wing spar with no ballast necessary. Enjoy! ***MB***

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BY GEORGE VOSS

The Super Skybolt From Great Planes

Long considered one of the most attractive homebuilt biplanes ever designed, the Super Skybolt makes a wonderful sport scale model, one that's every bit as aerobatic as its full-size counterpart.

If you've admired flying machines for any length of time, I don't have to remind you of the magic a biplane has. There's something special about those two-winged craft that will stop us in our tracks and cause us to crane our necks skyward to watch their beauty. One of the prettiest of the homebuilt bipes is the late Lamar Steen's Super Skybolt, offered as an RC model kit for .60-1.20 size engines by Great Planes.

Being from Great Planes, you would expect this to be an exceptionally nice kit, and it is. Supplied are cleanly die-cut wood, sheeting and sticks, the landing gear, adjustable engine mount, canopy and more nuts, bolts and screws than I cared to count! The instruction book is one of the best I've

seen, with 72 pages and over 300 pictures and diagrams. I'd bet an experienced modeler could build the kit by the book even without the aid of the two sheets of computer-drawn plans. Page 72 of the book contains a two-view drawing to aid the modeler in designing a scale-like color scheme. I really like that feature. I found only one error on the plans and that was the size of the main wheels—the correct size is 2-3/4 inches.

CONSTRUCTION

The tail assembly is first on the list. Nothing unusual here, simply a combination of die-cut pieces and sticks glued together, sanded and sheeted with 1/16 balsa. This yields a set of strong, light tailfeathers.

Most of the construction time is spent on the fuselage. It's not hard to build, but there are lots of pieces. The fuselage sides are made up from eight pieces of die-cut balsa and sanded smooth. Assembly starts with the rear bulkhead and you work your way forward from there. I had some minor difficulty installing the rear wing hold-down block; BP was glued in per the instructions, preventing the hold-down block from snap-

George sure knows how to make points with us!

The author's Super Skybolt is definitely no slouch with that powerful pump-equipped O.S. 1.20 Surpass providing the pull. Aerobatic performance is outstanding.

The Skybolt has no nasty surprises in store for you at slow speeds, and all controls are effective right up to the stall. All in all, it's really a joy to fly, says the author.

The O.S. 1.20 Surpass With Pump

OK, so I'm slow to be a convert. I'd seen many others switch to four-strokes and extol their virtues—lots of torque, lower fuel consumption, etc. But I was a two-stroke devotee and planned to stay that way. The O.S. 1.20 changed my mind. I love this motor!

Quality is typical O.S.—excellent. The motor generally starts on the first flip and is a real powerhouse. I think it's a perfect match for the Great Planes Super Skybolt.

If you're still holding off getting a four-stroke, I think a little exposure to the O.S. 1.20 Surpass will change your mind. It's a quality piece of machinery that will give you years of excellent service. **MB**

ping in place. The remaining parts up to the firewall went in without difficulty.

I ran into trouble when I drilled the firewall for the J-Tec 122-SV mount shown on the plans; the upper left-hand bolt hole was right where the cabane holder mounts to the firewall. I had to modify the cabane holder to allow proper installation of both it and the engine mount.

The cabanes are easy to make. You do have to solder the cabanes together; a propane torch made this task easy. With the tank and cabane holders installed, you can close up the forward side of the fuselage and install the turtledeck.

I deviated from the instructions when installing the fin and stab; I waited until the lower wing was completed and installed so I could align the stab with it. The fin can then be glued in place exactly perpendicular to the stab. Sanding and installing the landing gear finishes off the fuselage. I used a Klett tailwheel assembly instead of the kit supplied one—strictly personal preference.

The Skybolt's wings go together easily. The parts fit is excellent and the construction tabs make it easy to build warp-free wings. The wings are of D-tube construction with balsa spars and shear webs. There is no dihedral in the top wing; the lower wing dihedral is set by the top wing and the I-struts, which are balsa/ply laminates. First you install the top wing and I-struts, then insert the I-struts into the lower wing panel halves, join the two lower panels and glue them together. It's a foolproof system and works fine.

The builder has a choice of aileron actuation methods. I chose to use two servos driving four ailerons. If you use this method, both wings have barn-door ailerons. If you use one aileron servo, the bottom wing has strip ailerons and the top wing has none.

The cowl and wheel pants are made of ABS plastic. Although I prefer fiberglass, the kit-supplied items worked fine and appear to be holding up well.

I like to install the radio completely before finishing my models; this way I can solve any installation problems without ruining the finish. The kit-supplied servo tray will work fine for three servos, but because I had installed an AMP smoke system, I had to make a new tray to support a fourth servo. The new tray was installed as far aft as possible to overcome the weight of the O.S. 1.20 four-stroke in the nose. If you use the supplied servo tray, add some 1/8x1/4 spruce to the bottom to give the servo screws more material to grab onto.

The Skybolt kit is furnished with 2-56 control rod hardware, however, considering the aerobatic capability of the model, I chose to substitute 4-40 hardware instead. I used Dave Brown pushrods for the elevator and pull-pull cables on the rudder. For guidance, I chose the new Infinity 660 radio from Airtronics. Their systems have given me excellent service for the last 10 years and the 660 performed flawlessly

GP'S SUPER SKYBOLT

WINGSPAN	57 in.
WING AREA	930 sq. in.
FLYING WEIGHT	8.5-9.5 lbs.
WING LOADING	21-23.5 oz./sq. ft.
OVERALL LENGTH	52 in.
POWER	.60-.91 two-stroke. .90-1.20 four-stroke.
RADIO	Four channels required.

Produced by Great Planes Model Manufacturing, P.O. Box 9021, Champaign, IL 61826-9021.

Photo of the Skybolt kit contents reveals a full complement of high-quality materials and hardware.

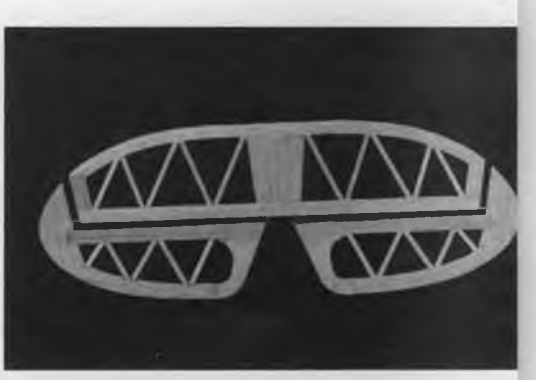
during this review. I used standard 102 servos for smoke and throttle and contest grade 732 servos on the rudder, elevator and ailerons.

FINISHING

To simulate a scale-like covering job, I used Super Coverite fabric, followed by Coverite's 21st Century primer and paint. This paint is really neat. I shot it under terrible conditions (95 degrees and 95 percent humidity) and it came out great. After I applied the decals and rub-ons, the entire ship was sprayed with clear K&B Super Poxy. The clear coat really brought out the sparkle in the metallic red and blue paint.

FLYING

After the cursory picture-taking ritual I headed out to the field to meet my test pilot, Bob Pastorello. Bob finished 7th in Masters at the '93 Nats, so I knew the Skybolt was in good hands. After a bout with the engine (our fault, not the engine's) the sun set in the west to end our flying day.



A combination of sticks and die-cut wood parts make up the horizontal stab (the fin and rudder are similar). All are then sheeted both sides with 1/16 balsa to yield a strong, light set of tailfeathers.

Our second trip was what the first should have been. The engine started on cue and everything worked like it was supposed to. The Skybolt's ground handling is good for a taildragger. We had a

Scale How-To: Rib Stitching

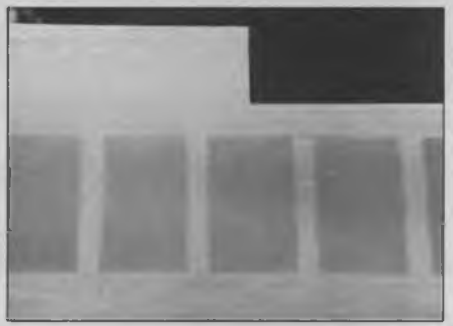
BY GEORGE VOSS

I had a feeling my Great Planes Super Skybolt was going to be a "keeper" from the start, so I put in a bit of extra time to make it more scale-like. One feature I wanted to add was simulated rib stitching, which I had never done before. One technique I'd read of used small pieces of cut fishing line to duplicate the stitching, but this looked like a very time consuming task.

Modeling buddy Jim Bishop told me about another buddy's method of simulating rib stitching. I tried it and it works great. It's also quicker than the fishing line method. The photos tell the story.

It should only take about one evening to put the simulated stitches on a wing and another evening for the pinking tape. It's not hard and will really put that finishing touch on your next project. Give it a try! ***MB***

■ LEFT: This technique involves putting lines of glue across the ribs to simulate the rib stitching cord. The glue to use is called Aleene's Tacky Glue, available at craft stores. It's a white glue that dries clear and doesn't get hard. RC-56 might work also. ■ CENTER: Use a soft pencil to lightly mark the stitch locations. If you have a full-scale model to copy, space the stitches accordingly. The author used a 1/2-inch spacing on his sport scale Skybolt. ■ RIGHT: Put a blob of glue on a piece of wax paper, pick up some glue on a toothpick and make a short line with the glue on each mark. Let them dry thoroughly.



■ LEFT: While the glue is drying, make up enough 3/8-inch wide pinked strips (Super Coverite in this case) to cover each rib. For smaller models, check the hairdressing section of your local variety store for 1/4-inch wide, pre-pinked tape—this should work also. ■ CENTER: Iron on the pinking tape and you're nearly done. Using a trim iron helps get between each stitch. If the pinked tape material you're using doesn't have its own heat-activated adhesive, a coat of Coverite's Balsarite or Sig's Stix-It will do the trick. ■ RIGHT: If you're using Super Coverite, coat the surfaces with three coats of dope to seal the edges of the pinking tape. Make sure the pinked edges are firmly ironed down before doping. This panel is done, awaiting paint and primer.

■ TOP LEFT: Cabane strut wires come pre-bent, but you have to bind and solder them together. Bottoms of the cabane wires are laminated between three pieces of plywood, which run from the firewall to the cockpit. ■ LEFT: George found that when he drilled the engine mount holes, the upper left hole interfered with the cabane mount. The solution was to notch the cabane mount to clear the engine mount bolt and then add a short plywood doubler to each side of the cabane mount to insure a strong attachment to the firewall. ■ ABOVE: George sure did a beautiful job of building his Skybolt. He went all the way and installed an AMP Smoke Master II smoke system, which can be seen mounted just forward of the landing gear.

quartering right headwind, so no right rudder was needed on takeoff. It quickly became apparent that the O.S. 1.20 was going to give excellent vertical performance. Only minor trim adjustments were needed for hands-off stability.

The nerves settle, the tank gets filled and we're ready for round two. On this flight, Bob pulled out all the stops. Aile-

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ron rolls, snaps, spins, tail slides, stall turns, you name it, the Skybolt will do it! But the most impressive thing to me is its stability. The winds were 10-15 mph on test day but the Skybolt made it look calm upstairs. It was absolutely rock solid. We found the ailerons and rudder to be quite effective. The recommended throws are good starting points.

Slow flight was most impressive. All control functions had authority up to the stall point. Slow flight showed no signs of tip stalling.

The Skybolt displays some typical biplane characteristics, i.e. roll coupled with rudder and yaw coupling with aileron. The Infinity 660 handled these mixes with ease. I'm not completely happy with my current mix ratios but the 660 has the capability to get me there.

CONCLUSION

The combination of the Great Planes Super Skybolt, O.S. 1.20, Infinity 660 and the AMP Smoke Master II is sure to peg the old fun meter. This isn't a recommended package for novices or the faint of heart, but if you can handle a low-wing sport pattern ship like an Ultra Sport, this is one potent package! The Skybolt does take some building skill, but the end result will reward the builder with a great looking, great flying airplane. I really enjoyed this kit. A tremendous amount of effort obviously went into it, and it shows. Great Planes, you have a winner! ***MB***

■ **ABOVE: The DGA pilot keeps a close eye on the kit-supplied Mylar decal instrument panel. Even a simple cockpit treatment like this adds much to the overall scale effect.**
■ **LEFT: Close-up of the tail wheel installation. The author likes to really wring out his aerobatic ships and therefore chose to substitute 4-40 linkage hardware for the 2-56 parts supplied. He also used pull-pull cables for the rudder control, and installed a scale-type Klett tailwheel assembly.**

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PLUG SPARKS

BY JOHN POND

• Gordon "Scotty" Murray Remembered

One of the biggest pieces of nostalgia this writer has run across comes through the courtesy of Jack Bolton, a retired Naval Commander living in the Pensacola area of Florida. Jack is seen in Photo No. 1 launching his good-flying Ohlsson .23 powered Scientific Coronet.

Being very active both in Old Timer FF and RC, Jack decided to revive the Scotty Murray Memorial contest originally started by Tommy McLaughlin back in 1976. At that time, Tom received an interesting letter from Carroll Moon who, due to his age in the Skyscrapers club (10 years senior to the oldest member), was the "Senior Director." Moon helped him keep the boys on the straight and narrow and keep them out of trouble.

Photo No. 1. Florida's Jack Bolton, seen here with his good-flying FF Scientific Coronet, is the spark plug behind the newly revived Scotty Murray Commemorative contest, to be held this coming October—details in text.

In 1937-40 the Skyscrapers had as many as 70 members, including Gordon "Scotty" Murray, Sal Taibi, Maurice Schoenbrun, Jerry Stoloff, Leon Shulman, Mickey Beitchman, and a host of others who gained prominence after the start of WWII, such as Jerry Brofman, Bob Tucker, Robert Hatschek, etc.

As Carroll Moon noted in his letter, Taibi was probably the most accomplished builder, but Scotty was certainly the fastest builder and better adjuster of gas models. During the time he was marketing his "Topper" design at Polks, he built five complete models in four days on a bridge table in his sister's bedroom. Then there was the time he and Jerry Stoloff brought an unopened kit and a new engine to the field at 9 a.m.; by noon, he had built and tested the model and flew it to 3rd place. Try that today!

In that gang of illustrious modelers is the living standout, Sal Taibi, who has more free flight designs to his credit than Carter has pills. Sal is shown in Photo No. 3 with his O&R .23 powered Brooklyn Dodger. Note the red/white/blue color scheme, which Sal generally uses on his latest models. In that same line, Photo No. 4 shows Tom Hammond with

Photo No. 2. Classic beauty itself! One of Scotty Murray's best-known designs is the Class A/B Topper, kitted by Bay Ridge.

Photo No. 3. Sal Taibi has probably lost count of how many Brooklyn Dodgers he's built over the years. He and many of his fellow Skyscrapers made a habit of winning the Nationals gas events back in the late '30s/early '40s.

Photo No. 4. A not-so-common Taibi-designed Winged Yankee as reproduced by SCIFS member Tom Hammond. Good flier with a Bantam .19.

Photo No. 5. Another famous member of the Skyscrapers, Leon Shulman, was the one responsible for the radical-looking Wedgy. Charles Yost of San Diego, California powers his FF version with an Albon 1.5cc diesel.

another Taibi design, a Winged Yankee with a Bantam .19.

Carroll Moon continues with his letter on Scotty, wherein he notes that Scotty used to baby-sit Moon's children. He writes:

"He did this so that he could use the building facilities in the cellar. For this, I also took him to many contests, one of which featured Scotty's Topper being hijacked.

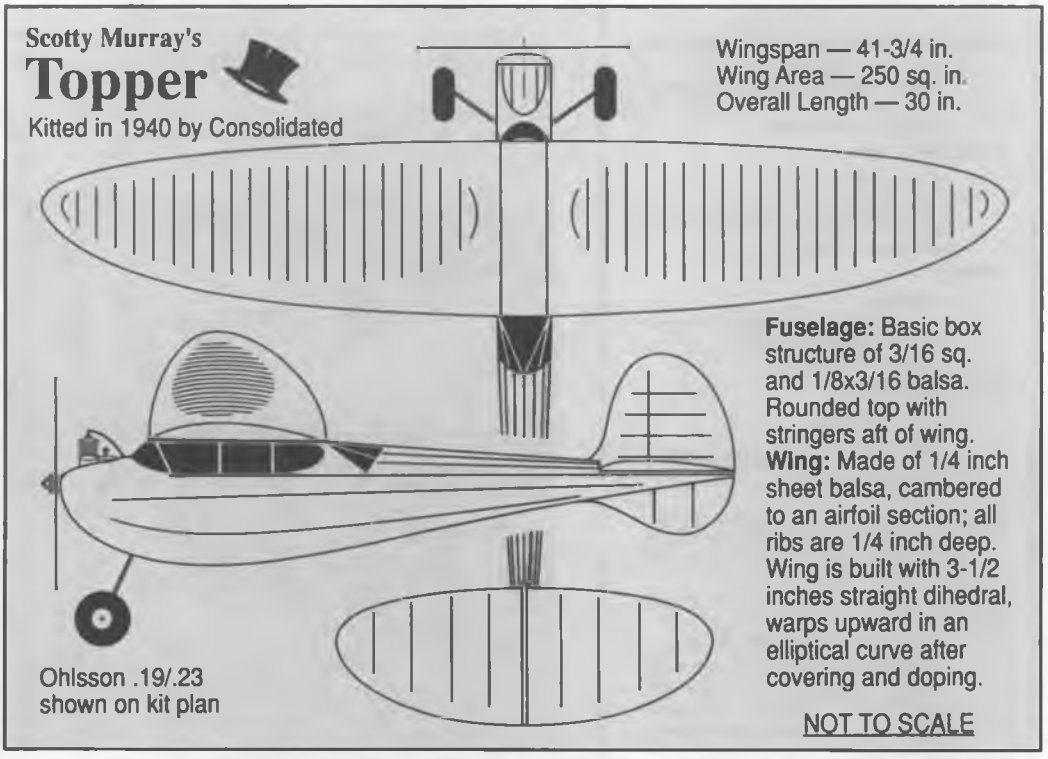
"Our club members had been hearing stories of a banana truck which hung around the down-wind area of the contest site and picked up the free flight models as they landed. While I was chasing a Topper for Scotty, I saw the model land and be promptly picked up on a narrow road. On seeing Scotty, the driver tried to run him down. Just about the time the truck got near, Scotty threw a 10-pound rock through the windshield. By the time I arrived, Scotty was trying to kill the guy barehanded. The thief got a year in the jug, as one of the planes in the van belonged to the son of the presiding judge.

"Scotty was so active that he nearly died at a Wakefield contest, having only consumed two Italian sausages and a Pepsi, and followed this with a gas contest in the afternoon. We took care of that on the way home. Scotty had a knack for adjusting the most unmanageable models. This proficiency extended to sailplanes, rubber power, hand-launch gliders and gas models."

Scotty was one of those modelers who had no compunctions about trying something new. Leon Shulman was also great at this—witness his Wedgy design. Charlie Yost is seen in Photo No. 5 with his version of the Wedgy with an Albon 1.5cc diesel. This model, with all its side area, very rarely spiraled in; instead, it would just lay flat on its side until the engine quit.

Probably the ship that set the pace for deep-bellied designs was the very successful Rock-eteer (Photo No. 6), as designed by Maurice Schoenbrun. This

MODEL OF THE MONTH



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model originally sported a single wheel up front, but most builders added another wheel to aid the take-off qualities. Schoenbrun followed this design with the Gladiator, Theo-Radical and several postwar designs.

Among the Skyscraper members was Jerry Brofman, who cooked up the Sunduster, one of the best deep-bellied designs. It was featured in the July 1942 issue of *Model Airplane News*. Evidently, the model had suffered some damage, as it was pictured in the article with a Sailplane wing.

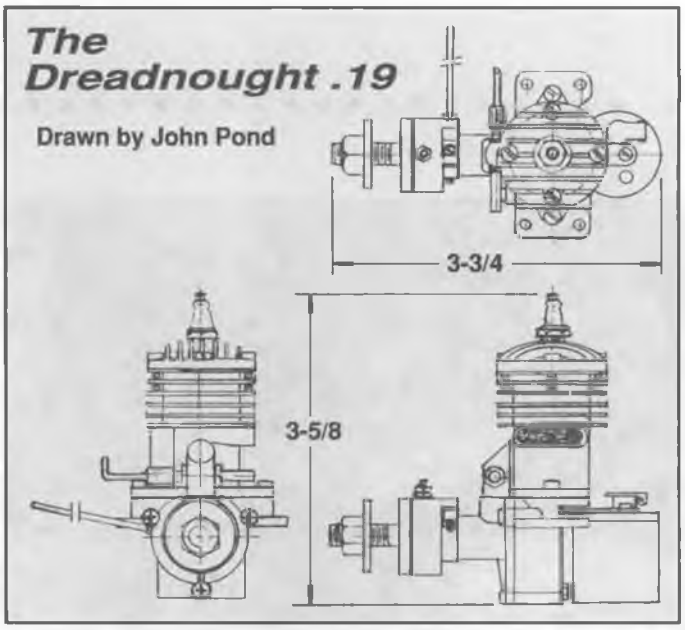
Seen in Photo No. 7 is Tom Patten of SAM 21 with a very good looking copy of the Sunduster. A similar model built by this columnist and powered by a rear rotor Torpedo .40 showed a spectacular climb and glide.

Having introduced a few of the more famous designs by prominent Skyscraper members, let's get back to the report by Carroll Moon on Gordon "Scotty" Murray. Money was pretty short in those days, so Scotty carved his own propellers out of old orange crate boxes. These were generally carved on the way to the flying field and as Carroll notes, they were darn good props.

When Scotty decided to enlist in the RCAF, he sold his favorite Ohlsson .23 to Carroll Moon. The engine had poor compression but would turn 8,500 rpm on a 10x6 propeller—very good for those days!

In the RCAF, Scotty soloed almost as soon as he touched a control stick. The general opinion was that Scotty knew more about aerodynamics than his instructor. He was once grounded for the harebrained trick of trying to land a Fleet trainer at 90 mph. Of course, the landing gear collapsed, eliciting a 90-day grounding.

Despite all the shenanigans, Scotty finally made it to the Battle of Britain. He shot down 27 German aircraft over the channel. When brought by carrier to Malta, he notched six more. Ironically, after landing for refueling, he got shot down by a raiding squadron while taking off—the most vulnerable time. Upon his death, he was posthumously awarded Britain's highest honor, the Victoria Cross.



ENGINE OF THE MONTH

ENGINE OF THE MONTH

Quite a few issues back, we featured the Dreadnought .24. As can be readily seen, comparison of the Dreadnought .19 to the

Photo No. 6. One of the most popular deep-bellied designs, the Rocketeer as designed by Maurice Schoenbrun back in 1939. John couldn't identify the builder of this glow-powered RC model.

Photo No. 7. Seen at the Santa Clara (California) field, an RC copy of Jerry Brofman's 1942 Sunduster by Tom Patten of SAM 21, who reports excellent performance.

.24 reveals that the smaller version was developed from the larger by reducing the engine's bore. This followed the example of the Ohlsson .23 being reduced and issued as a .19 for Class A competition.

While most modelers and engine collectors are fully acquainted with the big engine manufacturers in Southern California—Ohlsson, Atwood, Denny, Bunch, Moseley (Baby Cyclone), Orwick, and Hassad—there were a comparable number of engine manufacturers in the northern part of California, including the Hornet, Cave Cobra, and at least six companies in the San Francisco Bay Area—Vivell, Keener, Jim Brown, Hoosepian, Hiller, and a few other minor production shops. In short, California was extremely fortunate in having such a variety of engines available for just about any class of gas model competition.

MODEL OF THE MONTH

In line with the write-up on Scotty Murray's activities, we are presenting his unique sparless wing design known as the Topper, later kitted by Bay Ridge. The wing was very flexible and would assume an elliptical dihedral after the covering was doped. Murray claimed the model was easier to trim with this flexible wing. It is interesting to note that an identical cabin design by Murray, the "Answer," appeared in *Model Airplane News* in August 1940.

As mentioned before, the Topper/Answer was scaled 1-1/2 times to serve as a Class C ship. Using a Dennymite engine, this design set a Class C Gas record of 8:36. Murray claimed the larger version flew as well as the Class A/B version.

Of interest is that when Jerry's Hobby Shop, Burkhard and Bay Ridge merged to form Consolidated in 1942 because of wartime restrictions, the Topper was put out in two sizes: the original at 52 inches wingspan and a smaller 41-inch version aimed at the Class A engine market.

SCOTTY MURRAY COMMEMORATIVE

To wrap up this column, Jack Bolton announces the reactivation of the Fiesta of Five Flags free flight contest (known at one time as the Jim Kloth Memorial) to again be known as the Scotty Murray Commemorative. At present, the meet is scheduled for October 8-9, with eleven events on Saturday and another eleven on Sunday. While you're resting up, seven special events will be fitted in between the scheduled events on Saturday and Sunday. For full particulars, write Jack Bolton, 9521 Scenic Hwy., Pensacola, FL 32514, or call (904) 478-0442. Don't miss this big Southeast contest! ***MB***

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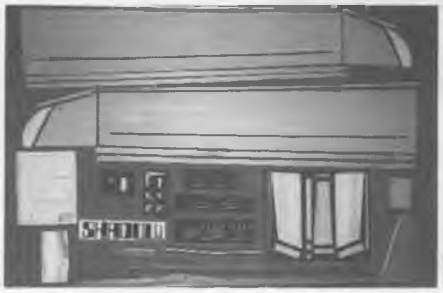

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A SPEED CONTROL PRIMER

We've come a long way from the days when controlling an electric motor meant hooking up a servo to a toggle switch. Modern electronic speed controls are very sophisticated units and can be purchased with a variety of different features.

In the dark ages of electric power, motor control was limited to a servo-operated on-off switch. As equipment evolved, motors were improved, batteries were improved, connectors were improved, and electronic speed controls (ESCs) were developed and improved. Today there are many kinds of ESCs available from a number of different manufacturers. Some have a built-in battery eliminator circuit (BEC), removing the need for a separate airborne radio battery. Some incorporate a "soft start" feature, which accelerates the motor up to full power over a period of one or two seconds. Others have an electronic brake for use with folding propellers. Some ESCs are designed to shut the motor off if the radio signal is lost. In the interest of demystifying these little black boxes, let's talk about how they work.

This information is summarized from two articles, one from the winter 1994 issue of the *NSP Quarterly,* the newsletter put out by Northeast Sailplane Products and written by Martin Euredjian (designer of the FX-35 speed control manufactured by AI/Robotics); the other is from the March 1994 issue of *The Ampeer,* the newsletter of the Electric Flyers Only club and written by Joe Utasi.

As I mentioned, the first method of controlling power to the motor was with a servo-operated on-off switch. This is acceptable for motors under 50 watts, but when you work with higher-power motors, several things happen. First, passing large amounts of current (greater than 15 amps) through a simple toggle switch can cause arcing within the switch and increase electrical resistance. In a similar fashion, instantly hitting a dead motor with high current can damage it in short order. And finally, high-power motors generate quite a bit of torque when instantly switched on—enough to possibly destroy the motor mount and severely damage the structure of the plane. Clearly, there has to be a better way to control power application.

To regulate motor speed, the first generation of speed controls placed a resistor in the motor circuit. A portion of the electrical energy generated the motor power we wanted; the rest turned to heat in the resistor and was wasted. Many entry-level RC cars and boats still use this method of controlling speed and after running them at half throttle, the heat generated is substantial. Most of these motors run at less than 100 watts.

FRAME VS. HIGH-RATE CONTROLS

Enter the "duty cycle," a concept where the current is rapidly turned on and off; the on-time and off-time defines the duty cycle. For instance, if power is applied for 20 milliseconds (thousandths of a second) then removed for 80 milliseconds, the duty cycle is said to be 20 percent (20/(20+80) = 20 percent). The rate at which the cycle repeats is called the frequency; the frequency in this example is 10 cycles per second (or Hertz, abbreviated Hz).

There are numerous speed controls on the market today, and they can be found in many different configurations. This month I have listed some important features to consider when shopping for one.

This method of controlling motor speed is much easier on the motor than cold starting it, and since there is no extra resistance in the circuit, very little heat is generated, and the motor doesn't have power applied from a dead stop. Early electronic units were designed to run at about 50 Hz—easy to do because this is also the frequency at which our radio receivers operate. These ESCs were known as "frame rate" controls.

After a time, experimenters discovered that even though it was convenient to design ESCs around the operation of the receiver, the motors still didn't like it. Although frame rate controls were far superior to the on-off switch, the higher-power motors were still affected by arcing and excessive torque. Raising the frequency solved this problem; speed controls today operate with frequencies from 800 to 5,000 Hz, and are known as high-rate ESCs. The electronic circuitry is more complicated, but there is less motor degradation and motor efficiency is much improved.

WHAT TO LOOK FOR IN A SPEED CONTROL

There are numerous speed controls on the market today, and they can be found in many different configurations. Here are some important features to consider when shopping for one:

1. Maximum number of cells or maximum voltage: When comparing the two, remember that a fully charged pack will generate about 1.4 volts per cell.

2. Maximum continuous amperes: Make sure that your motor system will not exceed the maximum current carrying capability of the speed control. Also keep in mind that carrying close to the maximum amount of current will generate heat, so a heat sink and proper airflow are very important.

3. Frequency: Frame rate units are OK for low power operation or for aircraft whose motor will be normally operated at full power or turned off. Partial throttle is available but at the cost of duration and heat build-up. Use a high rate unit for high power operation and/or where partial throttle operation is desired.

4. "ON" Resistance: This is the resistance of the speed control when the unit is fully on. Typical values range from 10 to 20 milliohms. Obviously, the lower the number, the better. Some specifications give a "voltage drop" value which can be converted to resistance if you have information about the current draw.

5. Time to Full "ON": This is a specification not normally found in data sheets, but if you can find it, look for the shortest times.

6. Battery Eliminator Circuit (BEC): This feature uses the motor battery pack to run both the motor and the receiver, saving weight and space in the fuselage. An ESC that has a BEC usually also has an automatic motor cutoff circuit which shuts off the motor when a pre-set voltage is reached, allowing the radio to keep working.

7. Soft Start: A speed control that "soft starts" the motor will ramp up the current over a period of one or two seconds instead of applying full power all at once to prevent damage to the motor and airframe. This feature is a necessity for large motors.

8. Brake: An electric motor can also

operate as an electrical generator. Turning the shaft will generate a voltage across the windings of the motor. Putting a resistor across the motor terminals will place a load on the motor and will make it harder to turn the shaft. With the advent of microprocessor-controlled ESCs, it's easy to add a brake by simply shorting the motor terminals when the power is off. This feature is almost essential if you're flying a powered glider with a folding prop.

SECRETS FROM JOE UTASI

Joe Utasi of Jomar describes five tests that he and other electric flight pros use to discern differences between speed controls. These tests work well with the microprocessor-based throttles that are becoming popular. According to Joe, "Some of the tests are sort of obvious, and some are out in left field, but they are a great way to separate the men from the boys."

Test 1: Input/Output Relationship

This test determines the relationship between moving the throttle stick and the speed of the motor. The motor may start up suddenly at a certain point, may not ramp up in a linear fashion as the throttle stick is moved forward, and may require less than full motion on the throttle stick to go from full off to full on. None of these characteristics is in itself a safety problem, but it's nice to understand your throttle's operating characteristics beforehand.

Test 2: Brownout

This test shows how well the throttle responds to control inputs when the receiver battery drops below normal operating voltage. This can happen if you're using a small receiver pack and/or have high servo activity. Hook up a 50-mAH receiver pack and two or three standard servos (with light servo loads—perhaps have a friend hold the output wheels), wiggle the sticks and observe the operation of the throttle. It should be smooth with no jitters.

Test 3: Lost Signal With and Without High Noise

A good and safe throttle should shut down the motor when the radio signal is lost. Turn on your transmitter and receiver and arm the motor, but leave the throttle stick in the off position. Turn off your transmitter and make sure the motor stays off. Try the same test again, but this time give it full throttle, then turn off the transmitter; the motor should shut off right away.

Next, try it one more time, but set the throttle at about three-quarters power, then turn off the transmitter. As a rule, speed controls and motors generate the most radio interference at partial throttle. This test will see how easily the control unit gets confused by this interference.

Test 4: Radio Interference

For this test you'll need another transmitter on your frequency. The procedure is obvious—set up your speed control, then turn on the other transmitter. We all know that the servos will go crazy, but the speed control

continued on page 78

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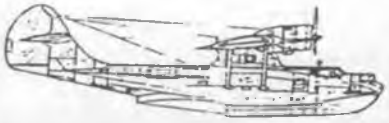

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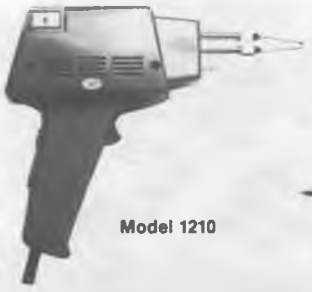

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COUNTER

continued from page 13

hardware is the machined aluminum, gold anodized servo arms being marketed under the Hangar 9 label. (Hangar 9 is Horizon Hobby Distributors' proprietary line of model aircraft accessories.) Made in single and dual-arm versions for JR/Airtronics and Futaba servos, the arms are 2mm thick and have 2mm threaded holes for Hangar 9's precision ball links, which are available separately and with either 2-56 or 4-40 linkage hardware. From Horizon Hobby Distributors, 3102 Clark Rd., Champaign, IL 61821.

UNLIMITED AEROBATICS

Direct Connection R/C is producing a pre-built, almost-ready-to-cover (ARC) model of the spectacular Ultimate 10-300S biplane, of all-balsa construction with composite landing gear and fiberglass cowl and wheel pants. The stock model spans 56 inches (the instructions detail a 60-inch span conversion for IMAA events), wing area is 1065 square inches, overall length is 60 inches, flying weight is 8 to 9-1/2 pounds, and the engine requirements call for a .60-.90 two-stroke or .90-1.50 four-stroke. The Direct Connection Ultimate 10-300S ARC retails for $349.99 and is available through Capstone R/C Suppliers, Inc., 562 W. Schrock Rd., Wester-ville, OH 43081; (614) 899-6313.

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The "Woodpecker" from Unique Model Products is an interesting device that lets you quickly put thousands of tiny holes in your uncovered model's wood surfaces, eliminating the gas bubbles that form when using some brands of iron-on coverings. The Woodpecker can also be used to aerate the primary covering in the same manner, allowing you to iron on trim materials without bubbles. The tool comes with four spiked wheels and can be set up with from one to all four, depending on the width of the area you want to aerate. Priced at $18.95 plus $2.60 S&H (and $1.47 sales tax if you're in California), from Unique Model Products, P.O. Box 2229, Lake Arrowhead, CA 92352-2229; (909) 336-5602.

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ELECTRIFYING ACE R/C'S

Whiz 40

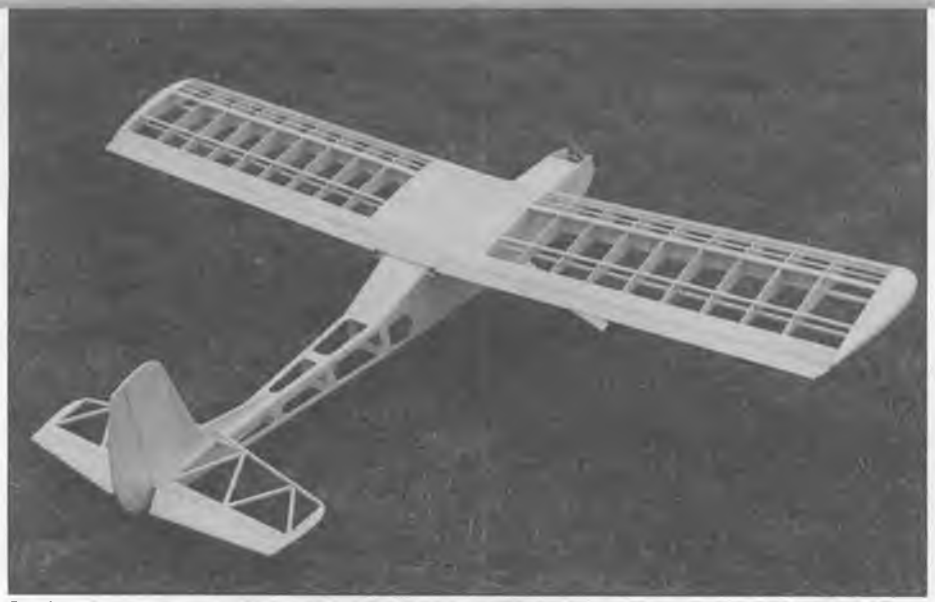
Ace's Whiz 40 gets double billing this month—as a normal kit review (page 63) and here as the subject of a very successful electric conversion. Many of the ideas described here can be applied to other "wet power" kits as well.

BY BERNARD CAWLEY, JR.

It wasn't until the author was halfway into this flight that he noticed the collapsed transmitter antenna; fortunately, the system didn't notice and continued to work perfectly—a testament to the performance of the Airtronics SR transmitter and Ace airborne package.

Back in the February 1992 issue of *Model Aviation,* Doc Mathews described his development of a new trainer design, the Whiz 40, subsequently kitted by Ace R/C. One of the design objectives that attracted my attention was the ability to fly on windy days, when most trainer types are grounded. Another was that it's a four-channel airplane, rather than the usual three—something I needed to advance my flying skills.

In May of last year, at the Celebration of Silent Flight in Vancouver, Washington, the Whiz 40 as an electric conversion came up in a conversation with Bob Benjamin.



Over half a pound was saved by replacing most of the stock fuselage structure (1/8 lite-ply) with balsa. Wing spars were also changed to balsa. Built-up horizontal stab replaces the solid balsa one supplied.

■ LEFT: One of the kit lite-ply fuselage pieces being used as a template for its balsa replacement. ■ RIGHT: The battery compartment is separated from the radio by a 1/8 balsa bulkhead (left). Three rows of cells rest on the three rails. An opening in the fuselage bottom allows cooling air to escape.

Several other Ace kits of Doc Mathews design were flying in the area as successful electric conversions, including a 4-20 with an Astro cobalt 15 and a couple of 4-40s on cobalt 40s. I studied the specs and decided it looked feasible, the likely power system being an Astro cobalt 40 on at least 18 cells. I also had the opportunity to try an another motor, a German Marx GT300/14 from Hobby Lobby, so I planned to set up the plane for both. With 840 square inches of wing area, the wing loading would be reasonable if the weight could be kept to about 7 pounds.

I wanted to do as straightforward a conversion as possible, making no aerodynamic changes and doing no major structural redesign. This meant using as many of the kit parts as possible, either directly or as patterns. Material substitutions to get the weight down and part omissions to eliminate unnecessary vibration-absorbing structure were fair game. In addition, I planned from the outset to set up the Whiz 40 with conventional gear, for a considerable savings in weight and drag.

■ LEFT: Bernard flew his electrified Whiz 40 with both a direct drive Marx GT300/14 motor (imported by Hobby Lobby) and a geared Astro 40. While not underpowered with the Marx, a relatively large airplane like the Whiz 40 (70-inch span, 840 square inches) is really better suited to a geared power system. ■ RIGHT: Each of the two motors has its own individual mount, which rests on a permanently installed, 2 inch long baseplate.

CONVERSION DETAILS

Weighing the various portions of the kit told me where the weight was in the design, and it also told me that I would have to take over a pound out of the structure in order to reach my target of 7 pounds.

The biggest modification, which was also the most work, was to change the basic fuselage structure from lite-ply to balsa. This involved using the kit parts as patterns for balsa replacements. This single change saved over a half pound. I preserved the tab-and-slot construction method, even though it was tedious to cut out, so as to take advantage of the virtually guaranteed trueness of the fuselage, and also so I could use a few of the kit parts without further modification. Fuselage joint doublers became 1/64 ply instead of 1/8 lite-ply. The firewall became a lamination of two layers of 1/32 ply with a 3/16 balsa core. The forward bottom of the fuselage was changed from 3/8 to 1/8 balsa (the side profile of the new balsa sides was changed to take this into account). These changes saved another 1.1 ounces.

In the end, I wound up using seven of the kit lite-ply parts in the fuselage—both parts of the aft cabin bulkhead, the upper forward cabin bulkhead, the wing saddle doublers and two of the four cheek pieces. I made the lower forward cabin bulkhead of heavier and stronger 1/8 birch aircraft plywood; this would be the front of the battery compartment and would have to restrain the motor battery in a sudden stop.

I planned from the outset to set up the Whiz 40 with conventional gear, for a considerable savings in weight and drag.

The wood for the tail group, which is 1/4-inch sheet balsa in the kit, was generally quite light. I did make a built-up horizontal stab; this only saved about half an ounce, though, and the plane tends to be a bit noseheavy anyway. The rudder was of much denser wood than the rest of the tail group, and I saved another half ounce by replacing it with a part cut from contest grade balsa.

I next looked at the 1/4x1/2 basswood beams supplied for the wing main spars and decided I could substitute firm balsa. As designed, the spar is shear webbed with 3/32 balsa nearly full span, which adds tremendous strength. I also substituted balsa for basswood for two of the three turbulator spars. These changes netted a 2-ounce weight savings.

After the material substitutions were made, I built the kit following the illustrated instruction manual with no real changes

continued on page 69

BY ELOY MAREZ

The Whiz 40 From Ace R/C

Serious about learning to fly RC? Here's a model that's large enough, stable enough and slow enough to be classed as a true trainer.

The Ace R/C Whiz 40, seen here in its K&B Super Poxy and MonoKote finish, has all the proper moments and areas required in a basic training airplane. The Whiz 40 could actually be considered a two-part trainer: in the workshop as a first building project, and in the air as a basic flight trainer.

Real model builders will know the feeling: "I want to build something!" It's different from the feeling of wanting a new airplane. It's wanting to glue and shape bits of wood, to see it develop, to create. That was me a few months ago; I had the urge to build something. I was drawn to the sporty lines of Ace's Whiz 40.

This airplane is plainly intended and marketed as a trainer, both a flight trainer and as a first project for the new builder. I can name a number of models that might be easier to build, but none have the realism that this one does, with its "something like a Cessna" classic looks. I really didn't need a trainer, but I can always use an inexpensive, forgiving airplane to test radios, break-in engines, and to fly just for the sake of flying.

In addition to three sheets of full-size plans and a die cut I.D. sheet, there is a 28-page illustrated manual that walks you through all of the construction and adjustment steps. If one can read and follow instructions and is reasonably adept with the few basic tools required, one can successfully build an Ace Whiz 40.

Included also with the deluxe version of this kit is a 40-page booklet entitled *Getting Started,* also by Whiz 40 designer D.B. "Doc" Mathews. This book, available separately from Ace ($5.95), should be recommended reading for all new flying enthusiasts, and covers everything from workshop requirements to actual flight. Your prospective student will be taking a giant step in the proper direction if you insist that he obtain one of these books and study it thoroughly.

The Whiz 40's large wing and long fuselage make for good visibility; the light wing loading results in slow, predictable flight. The semi-symmetrical airfoil makes the model capable of basic aerobatic maneuvers as the fledgling flier progresses to that point. The wide-stance aluminum landing gear provides excellent ground stability, even under crosswind conditions; it mounts to a lite-ply base with nylon bolts. The instructions also illustrate gear installation as a taildragger, and I was sorely tempted,

continued on page 74

ACE R/C'S WHIZ 40

WINGSPAN	70 in.
WING AREA	840 sq. in.
FLYING WEIGHT	6-1/4 lbs. as tested.
WING LOADING	17.15 oz./sq. ft.
OVERALL LENGTH	53-1/2 in.
ENGINE	.25-.45 two-stroke; .40-.60 four-stroke.
RADIO	Four channels required.
SUGGESTED RETAIL	$109.95 (Deluxe kit); $89.95 (Standard kit).

Produced and distributed by Ace R/C, Inc., 116 W. 19th St., P.O. Box 472, Higginsville, MO 64037-0472

The Robbe/Schluter Moskito RC Helicopter

Beginning fliers will want to take a close look at this interesting new model from Germany's largest producer of RC helicopters.

BY JAMES WANG

The new Robbe/Schluter Moskito is a .40-.50 size heli designed specifically for beginners, not as an all-out hotdogging machine. Its strengths are its very easy and solid hover, its ability to stand up to a beginner's abuse, and its easy and quick assembly, due to the low parts count, perfect parts fit and excellent drawings and instructions. My Moskito was ready to fly after only two evenings of work.

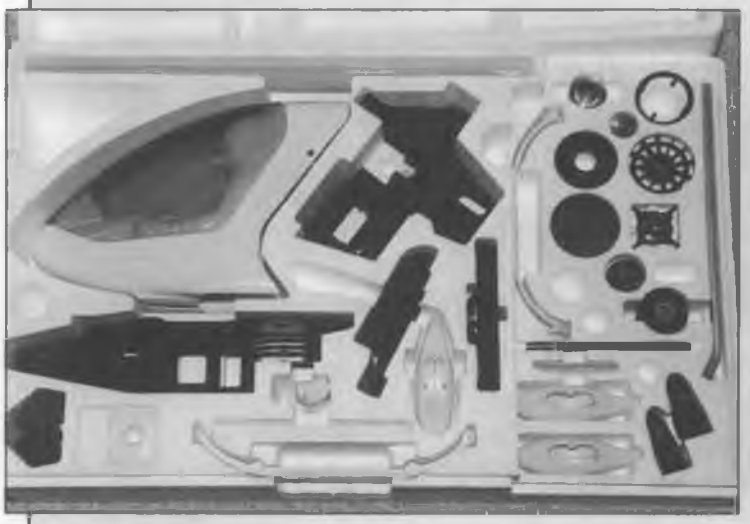
The engine in my Moskito is a Webra .50H, which I like very much. My friend David Ramsey in New Jersey uses an O.S. .46H in his, and Charles Leonard in Washington is using an Enya .50H.

I've been flying my Moskito for the past two months. It flies similar to David's, but mine has more cyclic throw, and more power. We've found the best hover rpm to be between 1,750 and 1,800; I prefer 1,750. Best forward flight rpm is between 1,800 and 2,000. Below 1,700 rpm, control responses become slow.

Even though not designed for aerobatics, my Moskito can perform loops, rolls, and even switchless inverted flight. I use +10 to -10 degrees of collective travel to make the Moskito aerobatic. The mechanics permit a total of 24 degrees of collective travel, but the engine cannot maintain a constant 1,800 rotor rpm when more than 10 degrees of collective is used. In throttle hold, I can bump up the top end collective to +13 degrees.

I like the main rotor head design on the Moskito; it is soft enough to give a mellow hover, but there is sufficient stiffness (meaning that the blades do not flap up and down easily) to give good, precise cyclic controls. For beginners, this is ideal. After 40

The Moskito reviewed here is the standard version, designed for beginners. There is also the Moskito Basic kit, a slightly smaller, less expensive model for .32-.40 size engines; and the bigger Moskito Expert, for aerobatics and 3-D hotdogging



■ FAR LEFT: All kit parts are neatly packaged in individual compartments. The main rotor head is pre-assembled at the factory. The canopy is a practically indestructible one-piece molded unit complete with pilot figure. ■ LEFT: This flamboyantly painted Moskito belongs to David Ramsey. Power is an O.S. .46H; the more powerful O.S. .50H proved to be too wide to fit the Moskito's mount. Note the tail rotor shaft, which gives good static stability and prevents boom strikes.

flights I added a very thin 8mm I.D. shim washer between the O-ring and the blade grip bearing to stiffen the flapping. This makes my Moskito slightly groovier in cyclic response. Beginners can do this themselves after they become proficient at hovering.

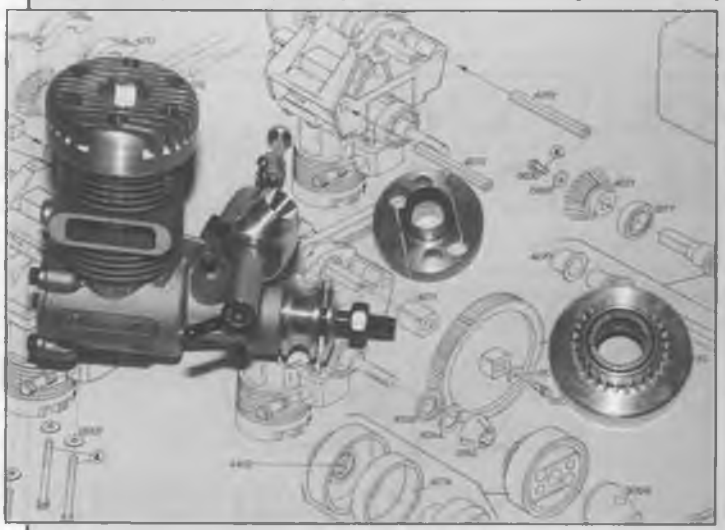
My Moskito climbs out about as fast as a Concept 30, which is decent. It cruises at around 50 mph. Forward flight is very stable, and turns are predictable. When making a steep banking turn, the model has a tendency to fall toward the center of the turn, therefore, after you've initiated the turn with lateral cyclic, simply release the lateral cyclic slightly. The horizontal tailplane is located very far aft, which enhances forward flight stability. The vertical fin is long enough to prevent the tail blades from contacting the ground.

David Ramsey discovered some coupling between the fore/aft cyclic and collective commands on his model. He says that when he increases the collective, the helicopter's nose drops, and when the collective is reduced, the nose goes up slightly. I personally like this coupling because in level forward flight, as I increase the throttle/collective, I usually need to add in some forward cyclic stick anyway. Some aft cyclic coupling as a result of reducing the collective is also desirable for me, because in switchless inverted flight it is desirable to have some aft cyclic to keep the model moving forward.

The Moskito's rotor speed remains fairly constant and the helicopter is stable during all phases of flight. Loops and rolls are gentle. The Moskito is exceptionally docile in hover mainly because of the thick and heavy Hiller paddles and the tall main rotor shaft. I'm now using the excellent Moskito paddles on my other .60-size helicopters with a 4mm flybar. The tall main rotor shaft gives good static stability and helps prevent the tail boom strikes that beginners frequently experience.

The 16 percent thick airfoil section on the Moskito's stock wood blades is excellent and gives good stability. The blades are very light—mine weigh 90 grams each—and have no lead inserts. With such light blades, there is little margin for error when doing an autorotation. I suggest adding 30 grams of lead near the leading edge of each blade, however, don't attempt this unless you have built weighted blades before. A router or milling machine is needed to do this job properly. Beginners should either seek the help of more experienced modelers when doing this, or just use the stock blades as is.

■ LEFT: James has been very impressed with the Webra .50H in his Moskito and recommends it highly. The centrifugal clutch and clutch bell are also shown here. Those wonderful drawings are typical of Robbe/Schluter kits. ■ RIGHT: All five servos (Futaba S148s in David Ramsey's model pictured here) are bolted directly to the molded sideframes. Gyro sits on the platform just behind the rotor shaft. Large fuel tank is easy to see in flight.



■ FAR LEFT: The Moskito's engine is mounted transversely. The transmission is completely enclosed. Cooling fan intake and cone start system are on the left side.
■ LEFT: Tail rotor is a completely enclosed belt drive unit. Plastic control balls are molded into the tail blade grips. Nice big fin.

I did try a set of .30-size fiberglass blades on my Moskito, but found that the Moskito's wider-chord stock wood blades still outperformed them. If you must have glass blades, a company called G-Blades in England makes inexpensive weighted fiberglass blades for the Moskito. They are available in the U.S. from Hobby Hangar in Earling, Kentucky at (606) 283-5746.

I'm using a Schluter S7196 tuned pipe and S0903 header for my Webra .50H. (The Enya .50H needs an S0904 header and the O.S. .46H needs an S0905 header.) I didn't use a muffler because I like the way the tuned pipe comes straight out the rear, parallel to the tail boom. This does make the model slightly tail heavy, though. Schluter makes a special muffler (S0930) to fit the headers listed above. I recommend using this muffler to help keep the CG forward. The Enya Special SM402 muffler fits the Enya .50H perfectly.

I compensated for the tail-heaviness caused by the tuned pipe by using a heavy 1200-mAH radio battery in the nose; this and the 10-ounce canopy brought the CG back under the rotor shaft. The canopy is a one-piece molded plastic unit and is almost indestructible. It mounts via a pair of rubber bumpers and two nylon bolts.

The Moskito kit includes both strut and three-wheel landing gear setups. At first I used the struts, but after 20 flights or so I switched to the wheels to see what it's like. The wheeled gear is fun to play with. On a concrete surface, I can do running takeoffs and touch-and-go's at up to 10 mph. With practice, I can skim off the ground at 30 mph.

The thing I like the most on the Moskito is its compact and very clean looking main rotor head design. I also like the unique engine cooling fan and starting cone location. The engine is mounted transversely; this allows the muffler to be mounted at the rear and diverts the exhaust away from the model. The small aluminum starting cone accepts any regular starter extension designed for .60-size models. When starting the engine, I step on the left skid with my left foot, grab the rotor head with my left hand and hold the starter in my right. The cooling fan has many blades, and there is no problem with engine overheating.

The transmission is a two-stage design—quite an engineering marvel. It permits building the Moskito with a clockwise or a counterclockwise turning rotor; I chose the former because all of my other models are clockwise rotation. The entire transmission is sealed to keep dirt out. The power train arrangement eliminates gear mesh adjustments that can be difficult and tedious for a beginner to set up. There is no way and no need to adjust anything. The one-way autorotation clutch uses a ratchet arrangement with spring-loaded pins riding on a ramped fitting. When the head is rotating faster than the main shaft drive, one can hear the ratchet clicking away. This system is similar to that used on Schluter Scout and Champion, and they work very well.

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The Moskito's tail rotor uses the well-proven toothed belt drive system. The belt drive is enclosed at the front and also at the tail rotor gearbox to seal out dirt. Once the tail boom is pulled out snugly and tightened, there is no further need for maintenance. There is also no need to pull hard on the tail boom to tighten the belt, because the belt has teeth and does not depend on friction to drive the tail rotor pulley.

The Moskito is the first helicopter from Schluter that uses molded composite sideframes instead of aluminum plates. They are extremely strong; recently I did a bad autorotation and the model landed very hard, but was undamaged. (The moral here is to only use weighted blades if you are using the Moskito to learn autorotations.) The Moskito's mainframe assembly is boxy and has many reinforcing webs, including where the tail boom attaches—very strong.

The servos screw directly into the plastic sideframes. The molded servo hole patterns fit Futaba, JR or Airtronics servos perfectly. The fuel tank fits snugly in a molded hole in the sideframes. The fuel level can be clearly seen from the right side during flight.

The Moskito's tail rotor control sensitivity is perfect for novice fliers. It won't do fast pirouettes in forward flight because the gear ratio between the tail rotor and main rotor is only around 3.6:1 (most helis have a 4.5:1 or 5:1 ratio). I'm using an inexpensive JR-130 gyro on mine, mounted on a platform behind the rotor shaft. The model holds the heading quite well in the wind, in hover and in forward flight. I only set the gyro on 20 percent, hence I get very good yaw response.

The Moskito is very competitively priced—at a suggested retail of $319.95, it's actually less expensive than many .30-.40 size models. The design, construction and assembly instructions are all geared toward beginners; in other words, an exceptionally easy to build, strong, and very docile, easy flying machine. The Moskito and all other Robbe/Schluter helicopters are now being distributed in the U.S. by Pica/Robbe, 2655 N.E. 188th St., Miami, FL 33180; (305) 932-1575. ***MB***

The Moskito is the only helicopter kit we know of that includes both struts and wheeled tricycle landing gear. James reports that touch-and-go's with the wheels installed are lots of fun.

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COUNTER *continued from page 58*

ELECTRIC FF SCALE

The latest addition to ScienText's line of electric free flight scale kits is a 28-1/2 inch span Noorduyn Norseman Mk. IV, which can be built with either wheels or floats. The Norseman is being offered as a semi-kit, consisting of full-size plans, patterns and

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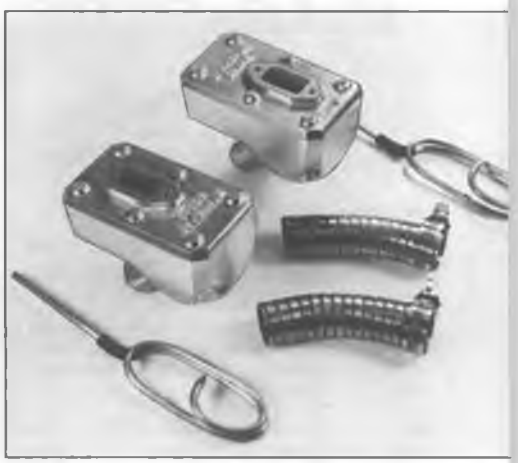
3W MUFFLERS

MB columnist Bruce Edwards talked about the large German-made 3W Modellmotoren engines in his May '94 Big Birds column; now J'Tec has come out with a set of mufflers for the 3W-70B2 twin. The mufflers are



cast aluminum, highly polished, and bolt directly to each cylinder; mounting bolts and flexible metal exhaust pipe extensions are included. They're priced at $115 per set. Optional pre-heater smoke coils are also offered at $15 per set. Coming soon will be similar setups for other 3W motors. Order direct from J'Tec (415-756-3400) or Desert Aircraft (602-722-0607). ***MB***

WHIZ 40 *continued from page 62*

except to make provisions for battery mounting and cooling, and to mount the motor and speed control. For guidance, I referred to Bob Kopski's article in the July 1991 issue of *Model Aviation,* where he describes his conversion of the Sig Seniorita to electric power. I unabashedly stole both the battery and motor mounting provision ideas directly from that article.

The cabin area under the wing was divided into two sections, with a 1/8 balsa bulkhead placed about 6-1/4 inches aft of the front bulkhead. The forward part of the cabin became the battery compartment, with the radio behind. In the battery compartment, after the Polymat reinforcing material around the landing gear mount was installed, three rails, made of 1/8 balsa capped with 1/8 square spruce, were positioned to support three rows of cells, with the rails under the center of each row of cells. The bottoms of the rails were shaped to fit the bottom of the fuselage inside, and the height was chosen to get the top of the battery up to the upper portion of the compartment below the crutch, allowing cooling air to flow freely, and raising the CG of the model a bit. A cooling air exit hole was cut in the aft end of the battery compartment under the rails to allow the cooling air to escape. On the sides of the battery compartment, 1/4-inch balsa strips were placed to keep the three rows of cells on the support rails.

The aft compartment contains an Ace ProStar FM receiver, attached with sticky-back Velcro, and Ace Import Special 330s for the elevator and rudder. The throttle servo was replaced with a Jomar SM-4 speed control, installed in a hole cut in the bottom of the forward fuselage, under where the fuel tank would be. The receiver battery nestles between two of the motor battery support rails in the front of the cabin and is secured with sticky-back Velcro.

Motor mounting had to be flexible so I could try both the Marx and Astro Flight motors, one direct drive and the other geared. The motor is retained on top of a plywood plate with 2-56 machine screws threaded into two straps made from the inner tube of nylon pushrods. On top of this fixed baseplate are interchangeable plywood plate/triangle stock assemblies fitted to each motor. The baseplate, made of 1/8 birch aircraft plywood, was mounted to the front of the firewall, perpendicular to it, so that the built-in downthrust angle is maintained. Some 1/2-inch triangle stock helps here. Also, a large hole was cut in the firewall to clear the motor and provide a cooling air intake; this is best done before installing the firewall, of course. The plate was positioned to just clear the nose gear mount if it were to be used, raising the thrustline slightly. The cheek pieces of the fuselage (I used only one on each side) were reshaped to shorten the nose slightly to allow this prop position.

continued on page 79

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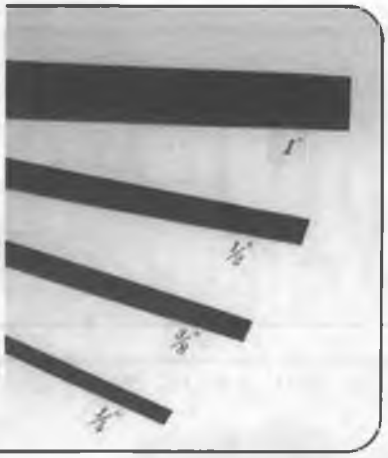

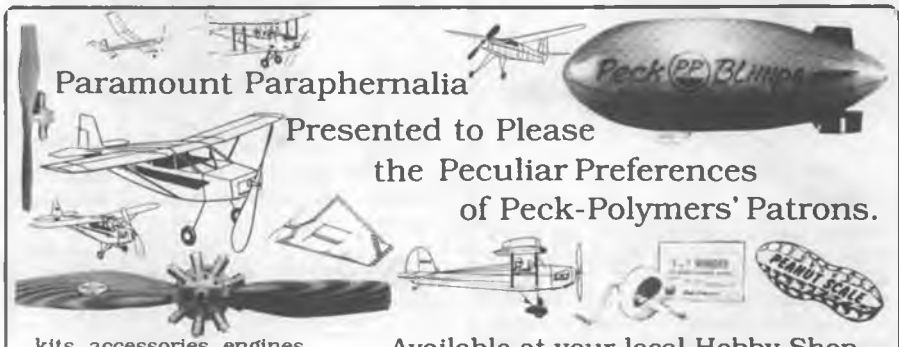

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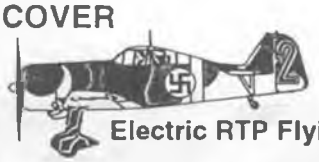

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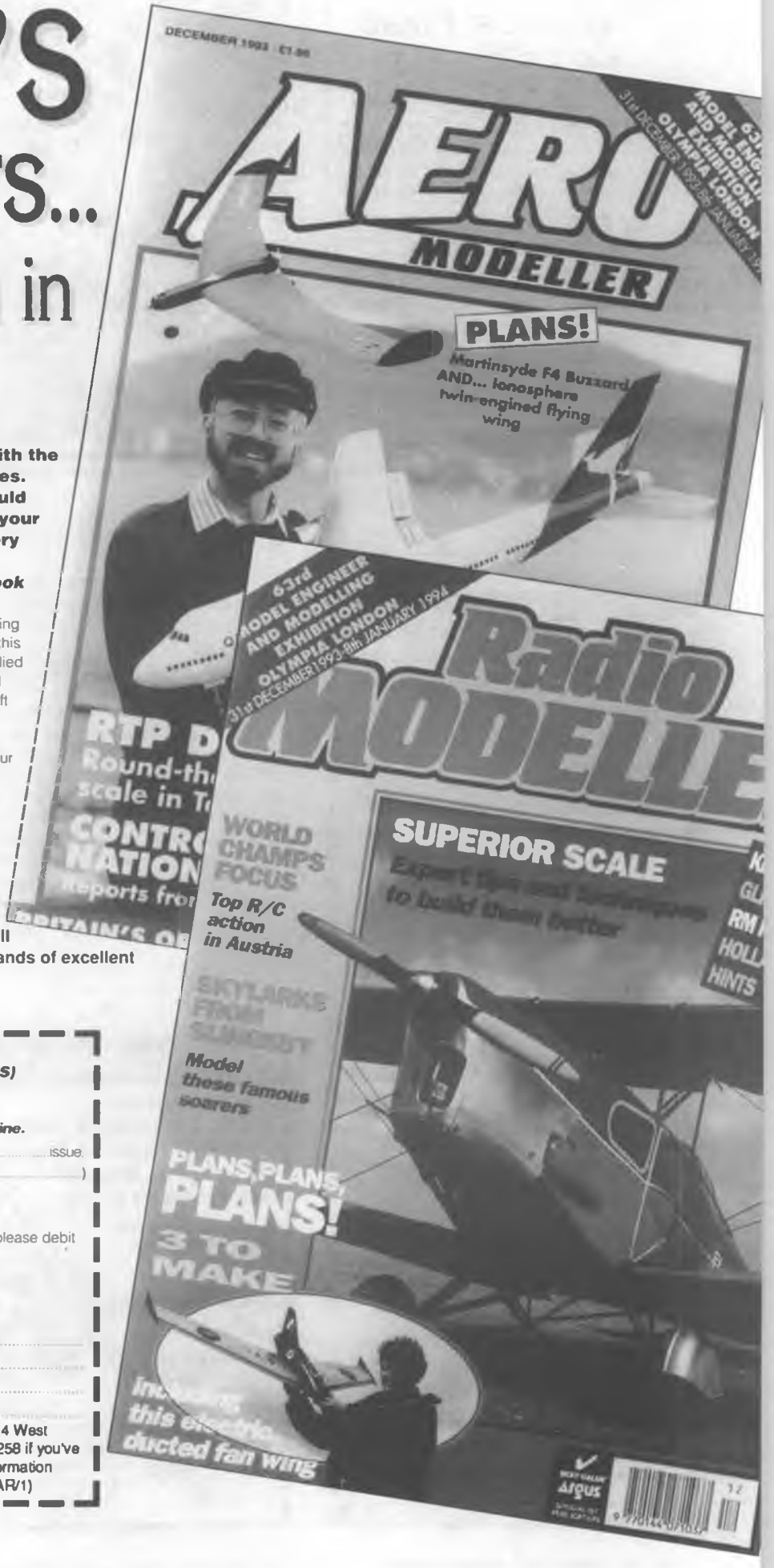

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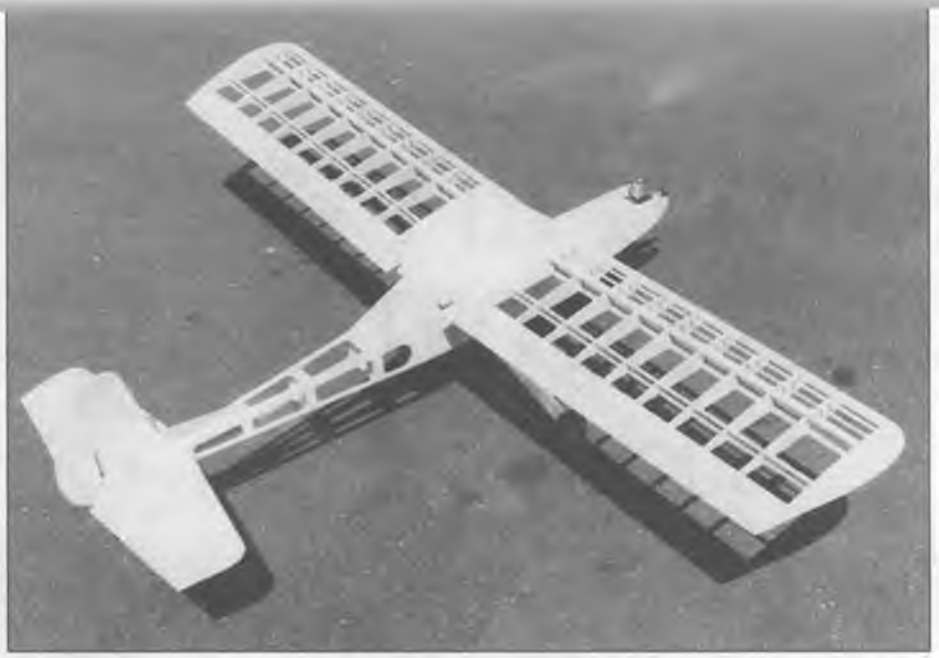

The Whiz 40 shows its traditional built-up structure of balsa, spruce and plywood. The only mods the author made are a bolt-on wing (looks better than rubber bands) and elimination of the hatch over the fuel tank; neither affects the flight characteristics.

WHIZ 40 *continued from page 63*

but the idea was to test the Whiz 40 as a trainer, and I firmly believe that the new flier is better off with a tricycle setup.

The Whiz 40 kit comes in two versions. The deluxe kit retails at $109.95, the standard version at $89.95. The seemingly high price of the former is offset by the fact that except for adhesives, covering, engine and radio, the kit is complete with all those necessary extras—engine mount, fuel tank, wheels, hinges, nuts and bolts, etc.—a retail total of about $75 worth of required items. For those who have some of the essentials from previously owned airplanes, the lower-priced standard kit does not include the wheels, tank, mount or *Getting Started* book but does include all the smaller hardware.

Optional items offered by Ace are the wheel pants, seen on the main wheels on Ace's brochures, and on all three wheels on mine. You'll need Ace No. 60K37 ($9.75/pair) for the main wheels, No. 60K36 ($7.95/pair) for the nose wheel. The pants are plastic, in halves which have to be joined together with CA and fiberglass tape inside.

In order to evaluate the kit fairly, my Whiz 40 is built according to instructions, with the following minor exceptions which don't affect its performance to any degree.

FUSELAGE

The landing gear is held in place with nylon bolts in holes threaded into the plywood fuselage bottom. A metal bolt is provided to be used as a tap before installation of the nylon bolts, and while this will work, a real tap only costs a couple of bucks and is a useful tool to have anyway. In any event, after running the bolt or tap through the wood once, apply some thin CA glue to the threads and re-tap them. This hardens the threads, making them a lot more secure.

The cabin section of the fuselage butt-joins laterally against the lower pieces. After the fuselage is assembled, 3/8-inch triangular balsa reinforcements should be added lengthwise in front of the forward bulkhead and back of the rear bulkhead to provide some additional gluing surface.

The fuselage is designed with a removable hatch over the tank compartment. I've never had a hatch that didn't ultimately allow some fuel seepage into the tank compartment, therefore I didn't use one here. The fuselage is large enough for easy installation of the tank through the cabin, but test this before you seal everything up. Be sure to wrap a length of strong cord lengthwise around the tank, with a loop at the rear so that you can pull it out should it become necessary.

WING

A 1/4x5/16 trailing edge cap is used on the wing along the aileron hingeline. I found it easier to install this strip using

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aliphatic glue along the bottom, securing the top with CA. Pins along the bottom will assure a tight fit until the glue dries. (Actually, wings should always be pinned or otherwise secured to the building board overnight even when assembled fully with "instant" glues.)

As I don't like my wings held on by rubber bands, the center section of the wing on my Whiz 40 received major modifications, as detailed in the drawing. For all these mods, aliphatic glue or epoxy is definitely called for. The wing dowel extends into a hole in the cabin front former; for perfect alignment, all three holes can be drilled at once with the wing temporarily rubber banded in place.

The wingtips are of molded plastic; they look good and are definitely lighter than solid balsa tips. When covering, use heat sparingly, as too much will probably distort the light plastic.

FINISHING

Plastic film coverings and I don't get along. Oh, I guess my plastic covering jobs are acceptable, but I don't feel as good about them as I do about the rest of my building. I also don't like the fact that in

continued on page 80

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-Jeff Troy, RC Scale Editor
Model Aviation Magazine, June, 1994

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BY SKIP RUFF

The Junior 451 From D&B Import/Export

The Russians are producing some pretty neat modeling goodies these days, not the least of which is this molded foam, CO_2 powered free flight. Makes a great father/son project.

For something a little different and exotic, how about this? An impressive ARF CO_2 powered free flight model from Russia!

Imported into the U.S. by D&B Import/Export Inc. and distributed by Sig Manufacturing, this little all-foam, 27-1/2 inch span model comes in its own sturdy foam container (which can double as a storage/carrying case if the wing dowels are not glued in place), complete with CO_2 motor, prop, charger and virtually everything else needed for assembly and flight except adhesives and CO_2 cartridges. Also included is a small container of spare parts for the power system, such as a piston, three valve balls, a valve seat, prop nut, charger bushing, filter screen, filler tip and assorted O-rings. A beautiful four-color Mylar decal sheet tops off the kit contents.

The instructions cover construction, flying, motor theory and operation, and contain excellent drawings including cutaways and exploded views of the motor and charger. Although written in Russian, an eight-page English translation is included.

Wesley Ruff, age 7, gives the Junior 451 a serious look. Actually, the lack of a smile is due to a lack of front teeth!

This being my first experience with CO_2 power, I found the little DP-03 motor intriguing. It displaces .27cc (.016 cubic inch), weighs slightly over 1 ounce with fuel tank and the supplied 7x8 prop, and has an operating range of 2,000-3,000 rpm. The motor utilizes a plastic crankcase, aluminum crankshaft with a steel prop stud, an aluminum and plastic connecting rod, plastic piston, and aluminum cylinder, head and tank. The rpm can be adjusted by screwing the cylinder in or out of the crankcase. It's really a nicely made, well-thought-out unit.

CONSTRUCTION

"Assembly" is more like it, since the basic steps consist of gluing the fuselage halves and tail section together, applying the decals (optional), bolting on the motor, snapping the landing gear in place and rubber banding the wing and horizontal stab on. That's it!

Glues compatible with molded foam should be used, as anything else may attack the parts. I used Goldberg's new Epoxy Plus, a two-part epoxy that sets up in 8 minutes and, best of all, is white in color,

ЮНИОР must be the Russian word for "Junior." Except for adhesives and CO_2 cartridges, the kit is 100 percent complete and even includes a few spare motor parts. Illustrated instructions are in Russian, but a separate eight-page typed English translation is also supplied.

giving you almost invisible glue joints on foam.

The parts fit was first rate—I've never seen better! Actually, the most time consuming portion of the assembly was the application of the adhesive-backed decals. They have to be cut from the sheet with scissors and have a tendency to curl up like crazy once the backing is removed. Clean hands and patience are required here if you want to have an attractive model! Once in place, some of the decals still tended to curl a bit at the edges, but this was remedied with a few dabs of epoxy. *(Editor's note: According to Dan Rutherford of D&B, the decals won't curl if you use a #11 blade and a straightedge to cut them out.)*

■ LEFT: The DP-03 CO_2 motor installed and ready to go. Motor rpm can be adjusted by rotating the cylinder.
■RIGHT: For those who like to build from scratch, the DP-03 CO_2 motor used in the Junior is also available by itself, complete with charger, prop and spare parts. Sig Mfg. Co. is distributing both the model and the motor here in the U.S.

FLYING

Completed and ready to go, my model checked in at about 3-1/4 ounces and required no ballast to balance properly.

I'm told this kit is produced by a company involved in Russia's aerospace industry, and it shows. In addition to the already mentioned excellent quality, the model flew without any trim adjustments being required. The motor can be adjusted to deliver a 15-second "power climb" or a 45-second "cruise" flight with very little gain in attitude. Flights average around 1 minute in dead, early morning/late evening air, which is the only time this model should be flown unless you're willing to risk losing it in a thermal.

My model has a slight left turn under power and transitions to a right turn in the glide. I found that the model will take some abuse, too. A full-power collision with a van resulted only in a slightly bent crankshaft, which was easily straightened after disassembling the motor. I also found that the model tends to go over on its nose on landings, even on moderately smooth surfaces. If I were building another one, I think I'd incline the landing gear forward 10-20 degrees to cure this. The gear can and should be removed when flying over grass.

Since the only CO_2 cartridges available in my area were the large size and the kit-supplied charger accepts only the small ones, I was given a Brown charger to use—which is designed for the large cartridges. With a full cartridge, it is possible, particularly in hot weather, to overfill the tank on the initial charge. This will result in the ball valve in the cylinder head being blown through its nylon seat, damaging both the seat and piston. It is suggested that the charger be held on its side or with the tip up, during the first charge or two, to avoid this.

The importer also told me that some of the chargers in the first batch of kits had a tendency to leak somewhat, but that the manufacturer has since remedied this with a completely redesigned unit.

At $35 retail, the Junior 451 is an inexpensive, quality product with, as mentioned, a bit of exotica thrown in, being from Russia ("with love," I assume!).

The entire DP-03 power unit is also available separately for $25, for those who want to build their own models. Peck-Polymers offers an excellent range of kits, their One Nite 28 and Dietrich Convertable (a 1938 rubber design) appearing to be a couple of good choices for this motor.

Whether you choose the entire package or just the motor, I'm sure you'll be happy with the results!

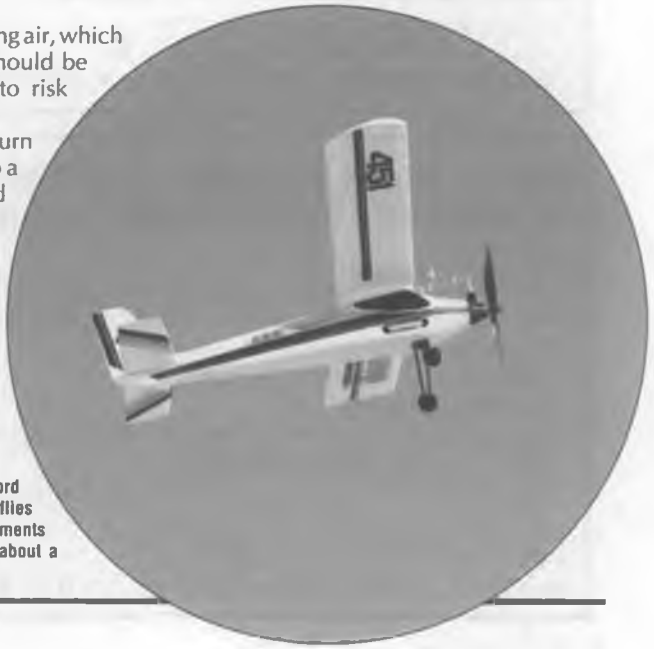
Following is a list of companies whose products were used in this article:

D&B Import/Export, Inc., 4705 237th Pl. S.E., Bothell, WA 98021; (206) 481-5760.

Sig Manufacturing, Inc., 401 S. Front St., Montezuma, IA 50171; (515) 623-5154.

Carl Goldberg Models, 4734 W. Chicago Ave., Chicago, IL 60651; (312) 626-9550.

Peck-Polymers, P.O. Box 710339, Santee, CA 92072-0399; (619) 448-1818. ***MB***



Skip confirmed what D&B's Dan Rutherford told us beforehand—that the Junior 451 flies right off the board with no trim adjustments required. In calm air, flights average about a minute.

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ELECTRIC *continued from page 57*

should shut down. If someone should turn on while you're flying, you'll still crash, but at least your motor will be off!

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At the end of his article, Joe says that these tests should only be done after thinking the process through and making sure that:

a) You have taken the necessary safety precautions (always!).

b) You are sure that your proposed test will not harm the speed control. "This speed control wasn't very good because it just burned up!" isn't a desirable conclusion.

c) You remember that these tests are only guidelines and that you are responsible for your own tests, test results and safety.

Joe credits electric flight experts Bernard Cawley, Bob Kopski, Keith Shaw and others for these tests.

• • •

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WHIZ 40 continued from page 69

Other changes made to conserve weight included use of a 270-mAH battery for the receiver, saving 1.7 ounces, and substitution of a medium-sized Klett fiberglass main landing gear, saving 3 ounces! The kit part, in contrast, weighs 7 ounces without axles.

The wing and horizontal stabilizer were covered with my old favorite, "clear" Coverite Micafilm (which everyone thinks is doped silkspan when they see it). At only 3/4 ounce per square yard, this is the lightest stuff I know of suitable for a plane this size. The fuselage and vertical tail were covered with yellow Coverite 21st Century film, because I wanted to try it. Overall, the plane gained about 4 ounces in covering. It would be at least a couple ounces more if it were all MonoKote, or all 21st Century, or whatever.

In the end, all-up weight, with the Marx GT300/14 motor and 18 1200-mAH SCR cells, was 6 pounds 11.4 ounces—over 4 ounces under my target! Great!

FLYING

First flights were made with the Marx motor on 18 cells, with an 11x6 APC prop installed. (This combination runs about 8,200 rpm at 18 amps static current draw.) The plane survived one of my first steer-with-the-left-thumb takeoffs and climbed out firmly if not steeply, with no feeling of being on the verge of a stall. In a short time it became clear that this combination was quite suitable for the basic trainer role. There was adequate power to loop from a shallow dive. Slow rolls and inverted flight (which took a very small amount of forward stick to hold) were easily done. The plane could even be coerced into an outside loop.

All in all, the plane handled gently and predictably, with no snaps or other nasty surprises. With the control throws recommended in the instructions, aileron response, especially at low speeds, is slow. The rudder is firmer; in my crossed-control experiments it was easy to overpower the ailerons with the rudder. Flights averaged about 6-1/2 minutes, not counting the taxi out to the runway.

After the first 10 flights, I replaced the 18-cell pack with one of 21 1400-mAH SCRs. In order to keep the motor current in line, I went to a 10x6 APC. This combination ran about 10,000 rpm at 18 amps. The extra three cells added about 6 ounces to the weight, bringing the plane just over 7 pounds.

Flights with this combination were zippier. The extra power clearly overcame the extra weight. Flying in the same manner as before, flights lengthened to about 8-1/2 minutes.

The plane really came alive, though, when I changed from the direct drive GT300 to a geared Astro cobalt 40. Using a 12x8 APC, this combination (still on 21 cells) turned about 8,200 RPM at 25 amps. All-up weight was now about 7 pounds 4 ounces.

continued on page 82

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WHIZ 40 *continued from page 63*

airplanes that live even to middle age, there is always some fuel seepage under the covering, especially around the nose. I've therefore adopted a compromise that works for me: I use plastic coverings on the wing and tail surfaces, but I paint the fuselage.

The Whiz 40 received such treatment. The open areas of the fuselage were covered with Coverite's pre-primed Micafilm, attached fiber side down with Coverite's Balsarite. The wood areas of the fuselage were then covered with 3/4-ounce glass cloth put on with K&B polyester resin, followed by two coats of K&B Super Poxy primer, followed by a sprayed coat of K&B Super Poxy paint.

The wing and tail are covered with MonoKote. The wing trim is standard MonoKote, put on with LDM Industries' "No-Heat Trim Solvent," a product intended to make MonoKote attach permanently to

■ LEFT: Two plywood plates are built into the wing to support the front wing dowel. Epoxy or aliphatic resin glue is recommended for use on all critical hardwood joints. ■ CENTER: For perfect alignment, the hole for the wing dowel is made through the reinforced front cabin former and both wing dowel supports simultaneously; here the drill bit is seen in place after the operation. ■ RIGHT: In keeping with the sport or trainer aspect of this project, Eloy went with a Webra Silverline .40, an inexpensive (only $99.95 suggested retail) ball bearing RC engine with a reputation for reliability and longevity.

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MonoKote without heat. It works well, although in areas where the underlying covering is not perfectly flat, i.e. has compound curves, the trim piece will probably not follow the contours without the application of heat. I learned this the hard way, the result being that some of the longer trim pieces on my Whiz 40's wing have a wrinkle here and there.

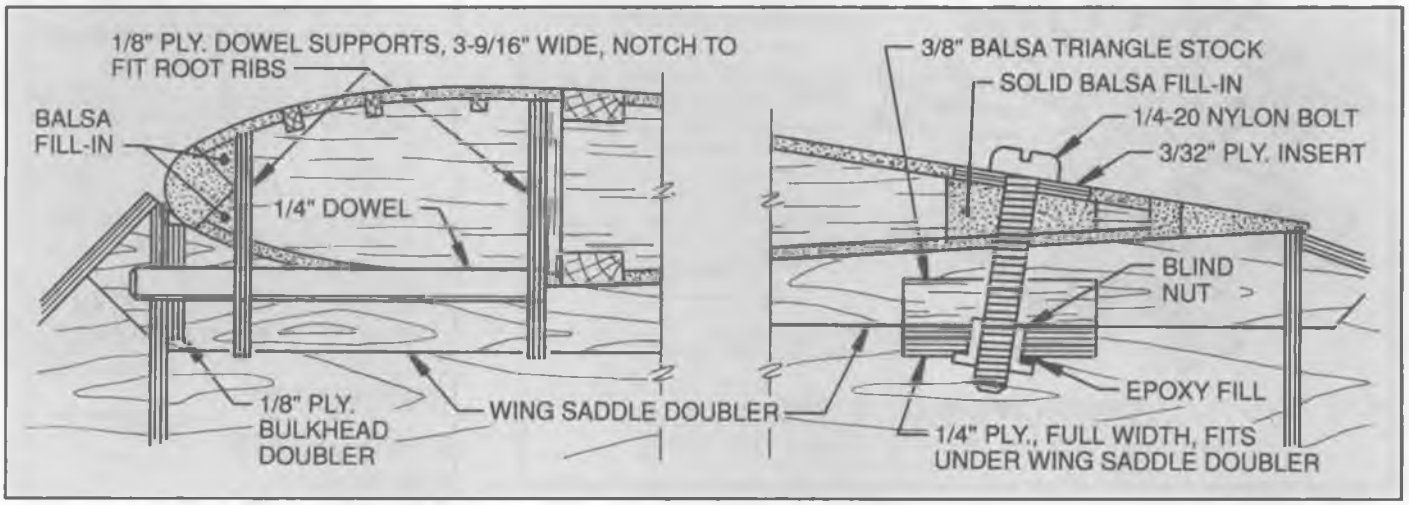
For power, I chose a Webra Silverline .40, for two reasons. First, I know Webra engines to run well, and when properly cared for, will last long past the time when you want to buy a new one just because you want a new one. Second, the Silverline is in the sport engine price class, the type of engine a beginning RC'er will be looking for, and I wanted to keep within those bounds. Ace R/C strongly recommends against overpowering the Whiz 40, and believe me, they are right. Even your old tired .40, if it runs reliably at all, will provide enough power for the type of flying this airplane is intended for.

FLYING

Test flying was done by Col. Bob "Ducted Fan" Thacker so I could take some flight photos. Set up as recommended in the instructions, Col. Bob reported the Whiz 40 to "have no unpleasant characteristics," and described it as an "ideal" trainer. Me? The airplane completely satisfied my building urge, and even though it's not a super scale airplane or a super performer, seeing it make the first takeoff brought a thrill that ARF and Stik fliers will never know!

If you are considering learning to fly RC, want to learn to build RC airplanes, or just have that urge to build something, I wholeheartedly recommend the Ace R/C Whiz 40. ***MB***

Modifying the Whiz 40's wing for a bolt-and-dowel hold-down isn't too big a job. This basic idea could be applied to many high-wing kits presently on the market.



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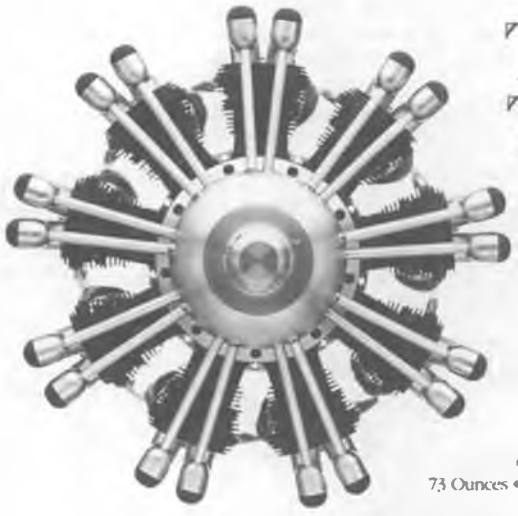
WHIZ 40 *continued from page 79*

Full-power takeoffs with this combination take only two or three airplane lengths and settle into a nearly 45 degree climbout. Large loops, both inside and outside, are easy. Flight times range from about 5 minutes at full power to about 8 if the plane is flown more gently. The plane cruises at less than half throttle.

This combination will give me the ability to learn much about four-channel aerobatics, the handling of coordinated and crossed controls, and more. It also gets approving comments from people at the Boeing Hawks field, with its turbine-like sound and its performance. All in all, this has been a satisfying project and a very successful electric conversion. I look forward to much good, quiet flying with my electrified Whiz 40. ***MB***

■ **LEFT: The motor is held down by means of straps made of inner Nyrod tubing; 2-56 screws are installed up through the bottom of the baseplate and are threaded into the tubing to hold the motor tightly in place.** ■ **RIGHT: Motor battery and radio system installation.**



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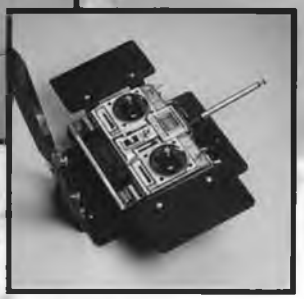

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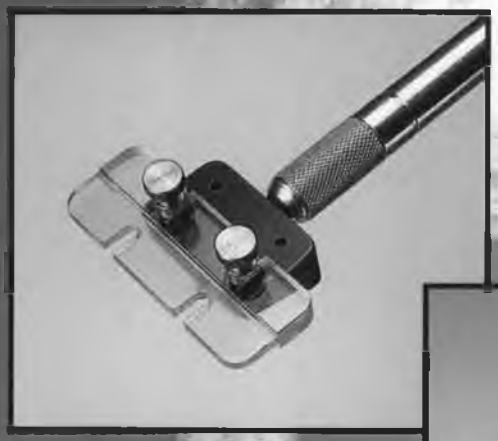

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