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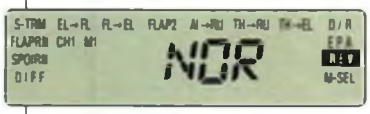

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ON THE COVER

A hands-down favorite among pilots and spectators alike at this year's World Soaring Jamboree was Eric Eiche's huge 1/4-scale replica of the German-built OBS vintage sailplane. The model attracted much interest, on account of its rarity, its sheer size (21-1/2 feet!) and Eric's impeccable workmanship. Inset: Another very attractive and unusual scale subject at the WSJ was Fred China's pretty twin-boom Sparrow, also built to 1/4-scale. Both photos were taken by Gregory Vasgerdsian, whose report on the WSJ begins on page 48.

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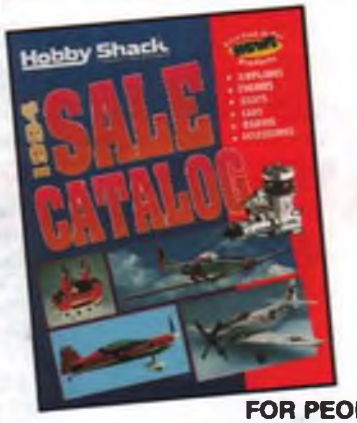

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Pictured with their entry for this year's Tournament of Champions, slated for Las Vegas in late October, are three generations of the famous Shulman family. Grandfather Leon Shulman (right background) is well known to Old Timer enthusiasts as a designer and winner of several national championships since 1939; he's been inducted into the halls of fame of AMA, SAM and National Free Flight Society. Leon taught his son Don to build and fly, and now 19-year-old grandson Jason (left foreground, shown with brother David), a top-rated RC precision aerobatics pilot, will fly a Godfrey 1/3-scale Laser for fame and money in the $133,500 contest. Leon and Don taught Jason to fly at age 3, and obviously did a good job. Wouldn't it be neat to see Jason wearing a custom *Model Builder* shirt in the winner's circle? *Leon Shulman, 173 Essex Ave., Metuchen, NJ 08840.*

Hardy Menagh reworked a Balsa USA Phaeton II to make a pretty convincing sorta-scale SE-5. Powered by a K&B .65 Sportster, the plane drops talc-filled bombs, is covered with olive drab and antique Aerospan and trimmed with Econocote. Modifications include reversed wingtips, plywood cowl, restructured tail and an SE-5 type tailskid. Hardy, who got into RC in 1991 when his wife gave him a hobby shop gift certificate, also flies electrics and sailplanes with the Green County Aeromodelers in Coxsackie. *Hardy Menagh, 16 Fox Greek Rd., Medusa, NY 12120.*

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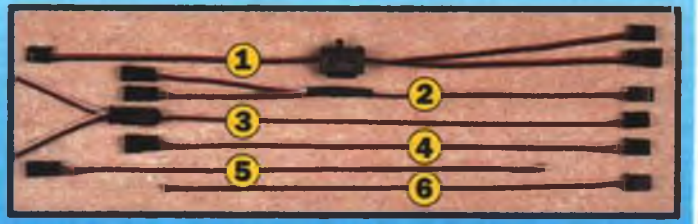

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More than half of the 12 members of Northern California's newest control line club are shown at the Yuba County Airport, where they've been given space to fly. From left are Bud Starr, Mike Bush, Clint Ormosen (president), John Hagler, Tom Hagler (secretary/treasurer), Trey Shrader (vice-president) and Bill Shrader. The Sutter Buttes Control Line Unlimited is associated with WAM, and they plan to raffle their *Model Builder* custom tee to raise lots of money! *John Brownlee, 1338 Hunn Rd., #1, Yuba City, CA 95993.*

Eric Becker built his as yet unnamed sailplane to explore the "infrequent thermals" near his Gallatin, Tennessee home. Construction is mostly balsa and spruce; the fuselage is finished in 3/4-ounce glass cloth and painted, while all other surfaces are MonoKoted. The wing features a 10 percent thick flat-bottom airfoil and spans 72 inches. The fuselage is designed around a Hitec receiver, two midget servos (probably in tandem) and four AAA dry cells. Overall weight is 25 ounces, for a wing loading of only 6 ounces per square foot. Eric's dad, Charlie, is pictured holding the ship. *Eric Becker, 1036 Woodmont Dr., Gallatin, TN 37066.*

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Now the pilot's seat can be yours with the Great Planes Super Skybolt. Modeled after the full-scale Skybolt, one of the most famous homebuilt show planes ever, the Great Planes Skybolt has the looks of a classic airshow bipe. A vacuum-formed clear canopy, molded wheel pants, aluminum landing gear and colorful decals all add to this bipe's realistic styling.

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When it comes to building the Skybolt, Great Planes traditional computer-designed construction helps you easily bring this beautiful scale model to life. Interlocking parts simplify cabane construction. Built-in jig-tabs make it easy to achieve a straight, true wing on any flat surface. A durable, quality-designed, two-piece cowl simplifies assembly even further (and looks great). When you get to the field, the Super Skybolt's unique wing attachment system makes set-up easy, too. First, slide the top wing into place. Next, quickly snap on the struts. The bottom wing can then be attached with only two nylon bolts. In just a few minutes, you're ready to fly.

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Dick Baxter of Laguna Niguel, California sends along this photo of his 12-year-old actor/modeler/grandson, Austin O'Brien, pictured holding his scratch-built Ministick indoor model. "Austin built the airplane, bent the tips and wing ribs, and covered it with film," says his proud Grandpa. "I just helped a little on the prop." The model turns in flights of 90 seconds and better in Baxter's two-story living room. *Dick Baxter, #2 Siros, Laguna Niguel, CA 92677.*

"Unhealthy Stealthy" is the name Oregon modeler Jim Trump gave his reworked Sig Wonder. He modified the wingtips, ailerons, elevator, fins, stabilizer and fuselage—call it the whole darn thing! He covered the ship with black Ultracote and decorated with DrySet markings. The engine is an older model Thunder Tiger .15, and the ship is controlled with a JR X-388S radio using Futaba FP-3002 servos. *Jim Trump, 2401 N.W. Kings Blvd., Corvallis, OR 97330.*

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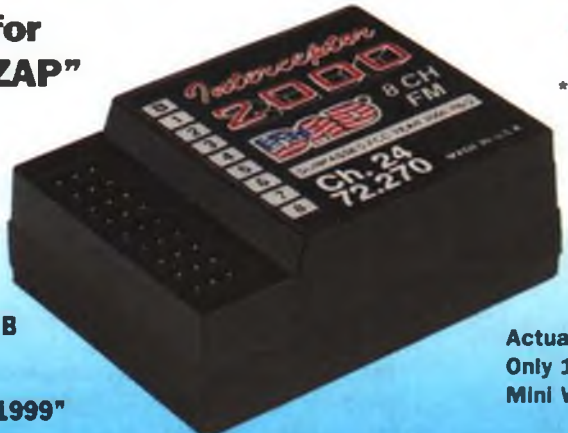

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KIT NO. RC-67

When the first SIG KADET came out 25 years ago, it was the only airplane on the market totally designed from the ground up for learning to fly R/C. Since then, thousands of new modelers have successfully learned to fly with a KADET! It's gentle flying characteristics made it a legend in it's own time! Now SIG has taken the time-tested KADET aerodynamics and blended in modern computer generated construction, to make the new KADET LT-40 the fastest building KADET yet!

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Like all SIG KADETS, the LT-40 behaves perfectly in flight, with true "hands off" stability on all axis. If the student pilot gets disoriented, merely let go of the control sticks and the LT-40 will recover itself and return to level flight within 2-4 seconds. Because the LT-40 is bigger than the average .40-size trainer, it's easier to see in the air. Even more important, the LT-40 has a much lighter wing loading than most other trainers, which lets it fly slower! Slower speed gives the student pilot more time to think and react to what the model is doing, thus making it a lot easier to learn to fly R/C!

We think this is the best trainer package put together by anyone!
See the KADET LT-40 at your local hobby shop.

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SPECIFICATIONS . . .
Engines: .30-.40 cu. in. 2-Stroke
.40-.50 cu. in. 4-Stroke
Wingspan: 70 in.
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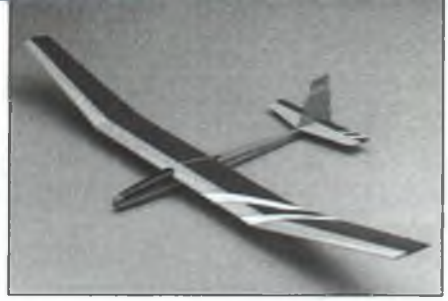


AN EVEN EASIER ANSWER

The "Easy Answer" 2-meter kit sailplane that graced the cover of the July '94 *Model Builder* and was the subject of a review article in that same issue is now also being offered in almost-ready-to-cover form, pre-built and ready for final assembly and covering in your choice of materials and colors. The Easy Answer ARC is a rudder/elevator floater, 568 square inches, and is built by the same craftsmen who turn out those beautiful ModelTech airframes, so you know the workmanship and materials are going to be first-rate. Suggested list is $115.00. From Global, 10725 Ellis Ave., Fountain Valley, CA 92728-8610; (714) 963-0133.

FLASH!

Coming soon from Hitec RCD will be the Flash 4 and Flash 5—FM computer sport radios with four and five channels respectively. Both have memory for two models, as well as the usual array of programmable electronic mixing, trim and timer functions; the differences are that the Flash 4 is supplied with three HS-300 servos, while the Flash 5 includes four HS-422 servos, dual rates on channels 1,2 and 4, a toggle switch for the fifth channel, and is set up for a trainer cord. Both come with RCD's Supreme receiver and feature NiCds all around. They're scheduled to be available in the U.S. sometime in October. From Hitec RCD, 10729 Wheatlands Ave., Suite C, Santee, CA 92071; (619) 258-4940. FAX: (619) 449-1002.

DC/SP ENGINES

Power fliers will want to check out the new DC/SP two-strokes recently introduced by Direct Connection R/C. Currently offered in .40, .46 and .53 sizes, these engines all feature a true ABC

piston/cylinder, dual ball bearing supported crankshaft, Schnuerle boost porting, twin-needle RC carb, muffler and a two-year limited warranty. Best of all, replacement parts are in stock and available for immediate delivery. You can see these engines at your local hobby shop, or call Direct Connection R/C at (800) 593-5250 to get all the details.

MINDBOGGLING RADIOS

Just when you thought modern computer RC systems couldn't possibly get any more complex, along comes JR's new PCM-10SX, in both helicopter and airplane versions, with a lengthy list of additions and upgrades. Some are new, some are expansions of existing features, but at any rate, there are far too many to talk about here. Horizon will be more than happy to fill you in on the particulars. Contact Horizon Hobby Distributors, 3102 Clark Rd., Champaign, IL 61821; (217) 355-0022.

LOW TECH & LOTS OF FUN

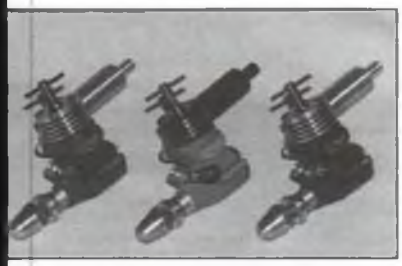
One of several new items in Hobby Lobby's latest catalog is a scaled-up version of an old Buzz Waltz favorite, the PS Flyer—sort of an electric sailplane with a landing gear and cabin fuselage, features which lend it a distinctly Old Timer flavor. Recommended power system for this 99-inch span, 1045 square inch floater is an inexpensive Graupner Speed 700 Turbo motor mated to a Graupner Power Gear 2:1 belt drive, running on two six- or seven-cell packs wired in series. The PS Flyer 99's two-piece wing makes storage and transport a cinch, but for those who still prefer something smaller, the original 78-inch span PS Flyer is also still available. Both are described in Catalog 24, free for the asking from Hobby Lobby, 5614 Franklin Pike Circle, Brentwood, TN 37027; (615) 373-1444.

PHILTECH DIESELS

One of the prettiest little engines we've seen in some time is the Australian-made Philtech 1.5cc (.09) diesel, now being imported into the U.S. by Carlson Engine Imports. These engines appear to be beautifully made, are supplied with muffler and spinner nut, and can be purchased in any of three color combinations (anodized aluminum cylinder head and baked enamel painted crankcase), with either a FF/CL venturi or RC carb. Advertised performance ranges from 10,000 rpm on an 8x6 prop to 16,000 on a 6x4. Full details on the Philtech engines are available from Carlson Engine Imports, 814 E. Marconi

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.

Ave., Phoenix, AZ 85022; (602) 863-1684. A complete 10-page catalog of all of Carlson's imported engines is yours for $1.00.



GP'S EASY SPORT 40

Great Planes' new Easy Sport 40 is designed to be a step up beyond your typical basic trainer, a good second airplane with the kind of performance and handling needed to learn the basic aerobatic maneuvers

while still being forgiving and easy to fly. Interlocking, self-aligning parts make for exceptionally fast, strong and accurate construction. There's even an Easy Sport Trim Package with self-adhesive markings that let you duplicate the blue/gray/red trim scheme on the box art. The model spans 59.2 inches and will take a .35-.46 two-stroke or .48-.80 four-stroke; suggested retail is $109.99. From Great Planes Model Mfg., P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-3630.

THE PLUG'R

Sooner or later, every RCer finds himself having to connect a tester, timer, cycler, charger, etc. to a battery pack or servo, and runs into the problem of incompatible connectors—and these days it seems like the number of different connectors is limited only by the number of RC manufacturers! A neat solution to the problem is the

"Plug'r" adapter from DAD Inc. It has connectors for Ace/Deans, Airtronics, Futaba J, Hitec/World/Aristocraft/Molex, Hitec/World/Aristocraft "S," and JR components; phone jacks (2mm and 2.5mm) are provided for hookup to chargers and test equipment. The Plug'r is available now from stock at all DAD dealers. Made in the USA by DAD Inc., 168 Main St., Chadron, NE 69337; (800) 669-4548.

HERCULEAN SERVO ARMS

Du-Bro's new Super Strength Servo Arms are just the ticket for heavy-duty applications, being molded from long fiber composite material for a considerable increase in strength over the ones normally supplied with servos. They're also longer than normal, allowing greater pushrod throw. Available for Futaba and JR/Airtronics servos, priced at $9.95 for a package of eight arms. Du-Bro Products, 480 Bonner Rd., Wauconda, IL 60084; (708) 526-2136.

WINDSTAR ARF SAILPLANE

Thunder Tiger USA's entry into the two-channel, rudder/elevator ARF sailplane market is the Windstar, a completely conventional (read: easy flying) design of about 2-meter span that comes precovered and requires only assembly and radio installation. The fact that the Windstar is of all-wood construction and is therefore easily repairable should make it especially appealing to beginners, who can count on having to break out the 5-minute epoxy a few times before becoming competent pilots. For full info on the Windstar, contact Thunder Tiger USA, 2430 Lacy Lane #120, Dallas, TX 75006; (214) 243-8238.

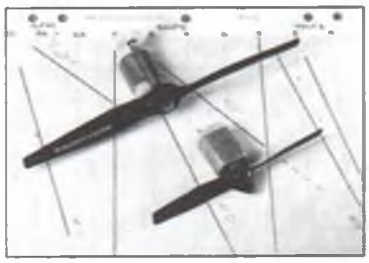
CL HOTROD

John Brodak has announced his company's new line of Fun Series control line model kits, the first of

which is a trainer/stunt/combat ship dubbed the Lightning Streak. Wing area is 388 square inches spread over a 41-1/2 inch span, and the specified engine size range is .19-.40. Included in the kit are full-size plans, illustrated building instructions, and individually packaged parts and hardware. The Lightning Streak kit is priced at $44.95 and can be purchased either through your local hobby shop or direct from Brodak's Manufacturing & Distributing Co., 100 Park Ave., Carmichaels, PA 15320; (412) 966-2726. Three bucks will get you a catalog of the entire Brodak product line.

MINI ELECTRICS

Regular *MB* readers will probably have noticed the "Have I got an electric motor for you!" classified ad that has run several times now. Dick Miller has apparently found a motor that does a fine job of flying small FF



or RC models. The direct drive MM1 motor weighs 1-1/4 ounces and operates on up to four cells; the MG1 is a simple and inexpensive geared version for three to five cells and models weighing up to 12 ounces. Interested? A large SASE will bring full particulars on these and the other goodies for micro/mini motors and planes available from R.C. Miller, 193 Huntzinger Rd., Wernersville, PA 19565.

SCALE SLOPE HOTDOGGER

Icare Sailplanes, based in Canada, manufactures an impressive line of RC sailplane fuselages and complete kits, one of which is a neat little Salto H-101 designed for burning up the slopes in light to medium strong winds. A small model at only 53-inch span and 210 square inches, the Salto uses the thin (fast) Goe 795 airfoil, features a white gelcoated glass fuselage and can be purchased with a built-up wood wing kit ($95) or

with factory built obechi-over-foam wings ($145). Either way, the kit is complete with plans, instructions, and all materials and hardware. Full details about Icare products can be yours for an SASE or $1.00 sent to Icare Sailplanes, 381 Joseph-Huet, Boucherville, PQ, J4B 2C5, Canada; (514) 449-9094. ***MB***

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

Basic Aerodynamics

When air flows past any object it produces a force on that object. The force will be parallel with the airflow if the object is symmetrical and lined up with the flow. This parallel force is called *drag*. If the object is not symmetrical or not lined up with the airflow, the force will be at an angle to the flow direction. We call this angled force the *resultant*, since we like to break it down into the drag force parallel to the flow and a force at right angles to it, which we call *lift*.

The magnitude of the resultant force depends on the shape, surface area and frontal area of the object, the density of the air, and the velocity of the airflow. The relative magnitude of its drag and lift components depend on the shape of the object. These forces are directly proportional to the area and air density, but are proportional to the square of the velocity. If the velocity is doubled, for instance, lift and drag forces increase four times.

A "lifting" component of force is developed at right angles to the airstream anytime a surface with a flow over it deflects some of that flow at an angle to its original flow direction. The lift force occurs because the air has weight and therefore inertia. A force must be exerted on the air in order to deflect it to a different path. The lift force is Newton's "equal and opposite reaction" to the deflecting force on the fluid.

The angle between the chord line of the wing airfoil and the airflow is called the *angle of attack*. As the angle of attack increases, the lift increases in direct proportion to the increase in the angle, until the stalling point of that airfoil is approached.

UPPER AND LOWER SURFACE LIFT

Lift is developed on both the bottom and top surfaces of a wing. Lift developed on the lower surface is sometimes called *pressure lift*, since the air pressure there is greater than atmospheric, tending to lift the wing. Immediately above the upper surface of a wing in flight the pressure is less than atmospheric, which again tends to lift the wing.

It's obvious why the pressure below the wing is greater than atmospheric. The wing runs into the air and compresses it a bit; impact produces pressure. The reason why the pressure above a wing is less than atmospheric is less obvious. In an airstream, if the velocity is increased the pressure is reduced, and vice versa. When the air flows over the curved upper surface it speeds up and its pressure is reduced.

LIFT-TO-DRAG RATIO

We normally try to maximize the lift and minimize the drag components of the resultant force, and speak of the *lift to drag ratio*, or L/D. This is a measure of the wing's lifting efficiency. In most applications, the higher the L/D, the better.

Maximum L/D on most airfoils is reached at a moderately low angle of attack—4 or 5 degrees. An airplane in high speed flight is usually flying at a much lower angle of attack, and during takeoff and landing it is flying at a much higher angle of attack.

LIFT & DRAG COEFFICIENTS

We use factors called *drag coefficient* and *lift coefficient*, or CD and CL, which quantify the effect of the shape and the angle of attack on the lift and drag of airfoils and other shapes. We measure the drag and lift coefficients of airfoils at different angles of attack in wind tunnels. The CDs and CLs are plotted, and the resulting curves can be found in aerodynamic books, magazines and reports.

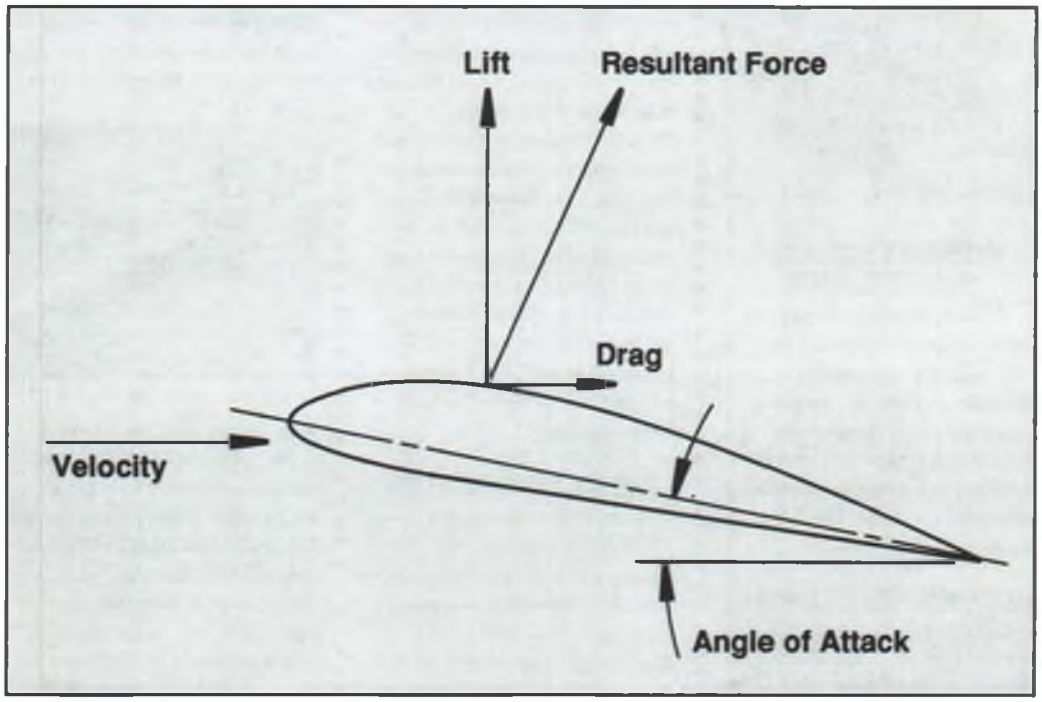
Here are a couple of simplified formulas for lift and drag, applicable to both full scale and models, which are convenient to use for sea level and "standard" temperature and barometric pressure conditions:

$L = (CL)(S)(V^2)/391$

and

$D = (CD)(S)(V^2)/391$

Both L and D are in pounds, CL and CD are dimensionless numbers taken from the airfoil data curves, S is wing planform surface area in square feet, and V is velocity in miles per hour.



A wing moving through a body of air at a positive angle of attack creates an aerodynamic force with both lift and drag components.

THE STALL

A stall occurs when the angle of attack increases to the point where the airflow on the upper surface of the wing no longer has enough energy to follow the shape of the airfoil, and breaks away or separates from the surface. The air pressure above the wing then rises, and most of the upper surface lift is lost.

The bottom of a wing doesn't stall; the lift generated by the lower surface of a wing continues to increase as the angle of attack is raised further. Around 40 percent or more of the total lift therefore remains after a stall.

Depending on the airfoil and other factors, the stall may be quite sudden and abrupt, or gentle. At 15 degrees angle of attack the lift may be maximum, and at 16 degrees the wing may be badly stalled. A different airfoil may have a very gradual stall, and the lift will remain near maximum over a number of degrees change in angle of attack. Thin airfoils and ones with sharp leading edges tend to have a more abrupt stall, and will stall at a lower angle than thick, rounded ones. The latter have more drag, however. Camber (curvature) in the airfoil increases both the CL and CD, but doesn't greatly affect the stall angle or the abruptness of the stall.

ASPECT RATIO

The wingspan divided by the average wing chord is called the *aspect ratio*, or AR. The higher the aspect ratio, the greater the lift and the lower the drag. In other words, narrow, long wings are more efficient.

To understand why, first remember that there is a high-pressure area below a lifting wing and a low-pressure area above it. The air below will therefore try to flow to the air above to equalize the pressure. On an airplane in flight, this pressure-neutralizing flow occurs at the wingtips. Air flows up around each tip from the high-pressure area below the wing to the low-pressure area on top. Since the plane is moving through the air, this curving flow at the wingtips gets left behind and forms a vortex or helically swirling air column trailing each tip.

Early wind tunnel model wings were made with an AR of 6, but modern airfoils are tested at infinite aspect ratio. This doesn't mean the wind tunnel models have an infinite span, of course. All that's required is to completely block any of the airflow from going around the wingtips. The test results are the same as though there were no tips, or as though the tips

continued on page 80

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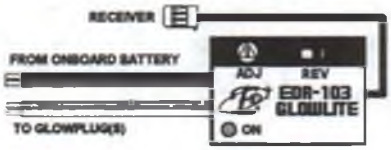

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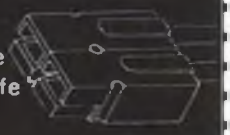

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ELECTRIC POWER POTPOURRI

Our columnist's Miscellaneous folder runneth over with good info. Included is a novel motor shaft straightening method, a way to cut balsa costs dramatically, newly introduced products, and more.

In my modeling files I have a folder labeled "Miscellaneous." When readers send ideas, notes and comments that are of interest yet aren't substantial enough by themselves to make an entire column, I put them in this folder. The folder is now bulging with information and it's time to share the wealth.

STRAIGHTENING MOTOR SHAFTS

Longtime electric modeler Jim Baron told me about this technique just minutes after I torqued one of my models into the ground and bent the motor shaft. If the shaft is bent severely this technique won't work, but if the shaft just has a wobble in it you may want to give it a try. Take a 7-inch table saw blade and attach it to the prop adapter as if it were a prop (it doesn't have to be centered). You will have to use a small scrap of wood or some metal washers as spacers because the saw blade isn't nearly as thick as an ordinary propeller.

After the blade is on, hold the motor in one hand and carefully turn the blade with the other. The wobble will become obvious immediately. To fix the wobble, just apply pressure at the end of the saw blade at the appropriate places. The leverage you get with the large diameter blade makes a difficult job very easy. A 10-inch blade makes it even easier. Give it a try next time you tweak a shaft—you'll be amazed at how well this works.

CHEAP BALSA

When I'm not flying or building model aircraft, I can usually be found on the other side of my garage doing some woodworking. With four children and a multitude of nieces and nephews, I always have homes for my wood projects. I now have two of each power tool—a big one for lumber and a small one for balsa!

In an effort to expose potential future modelers to the hobby, our columnist has teamed up with fellow electric fliers Phil Moore (right) and Harold Reed to demonstrate their models to the students at some of the local elementary schools. Story in text.

While shopping for some oak, cherry and poplar at a local hardwood retailer, I stumbled (literally) on a rack of 7- and 8-foot long blocks of balsa. Balsa is a popular material with the surfboard and boating crowd, and many large hardwood retailers stock long balsa blocks. (Because of its botanical characteristics, balsa is considered a hardwood even though it is one of the softest and lightest known woods.)

With material costs continually on the rise, one way for scratch builders to save some real bucks is to buy a block of balsa from the local hardwood supplier and strip your own stock on a bandsaw. Roger purchased this 7-footer (pictured with a yardstick for size comparison) for a mere $27!

I bought a block and brought it home, thinking I could cut it up on my bandsaw into planks and sheets suitable for model construction. Sure enough, for $27 I have thus far produced about $35 worth of balsa—and I still have half the block left! You need a full-size bandsaw with a tall fence that's absolutely perpendicular to the table; when cutting 1/16-inch sheets, there isn't much room for error. I've successfully sawed widths down to 1/32-inch, but this requires some care and practice. It's best to start by sawing a 1/4-inch sheet and working your way to thinner pieces as you gain experience and skill.

What about the balsa's quality and density? The quality is very good—maybe not as good as the hand-selected balsa available from the modeling manufacturers, but for most applications it is acceptable. I use it mostly for stringers, sheeting and ribs and save the expensive lightweight stuff for my smaller RC and free flight models. The density of my block was 8.8 pounds per cubic foot—not bad!

QUESTIONS FROM READERS

I received a letter from Ralph Evans of Tucson, Arizona, who asked if I knew of a sticky, high-temperature grease that will remain on pinion and gearbox gears. Ralph says that when he removes the gearbox after only a few seconds of running at maximum power, the grease has been plastered against the walls of the gearbox. Personally, I never use grease on my gears—I prefer to use a small amount of a light-duty oil instead. From my days in a bicycle repair shop, I learned that the only thing extra grease does is attract extra dirt—bad news for a motor and gearbox. I would like to hear from those readers who use grease; please tell me why you use it and where you find it so I can pass it along to Ralph.

Prolific modeler Jerry Smartt of Warsaw, Missouri has asked if I know of anyone who rewinds motors and where he can get pinion gears for gearboxes. He needs gears for different shaft sizes and has been unable to find anyone who can supply them. If you can help Jerry, please drop me a line and I'll pass the information on to him.

ELECTRIC POWER DEMO

Recently I was given an opportunity by the San Diego County Association of Model Clubs to help demonstrate RC aircraft to a group of elementary schoolchildren. After word spread among the students that they had the chance to see model airplanes actually fly, the "group" turned into most of the school!

With me were fellow electric modelers Phil Moore and Harold Reed. The photo shows Phil explaining the basic ins and outs of radio control and electric power to the kids while Harold flies one of their two Playboys in the background. It was very windy that day, which made it difficult to land the very light Playboys within the small confines of the school playground.

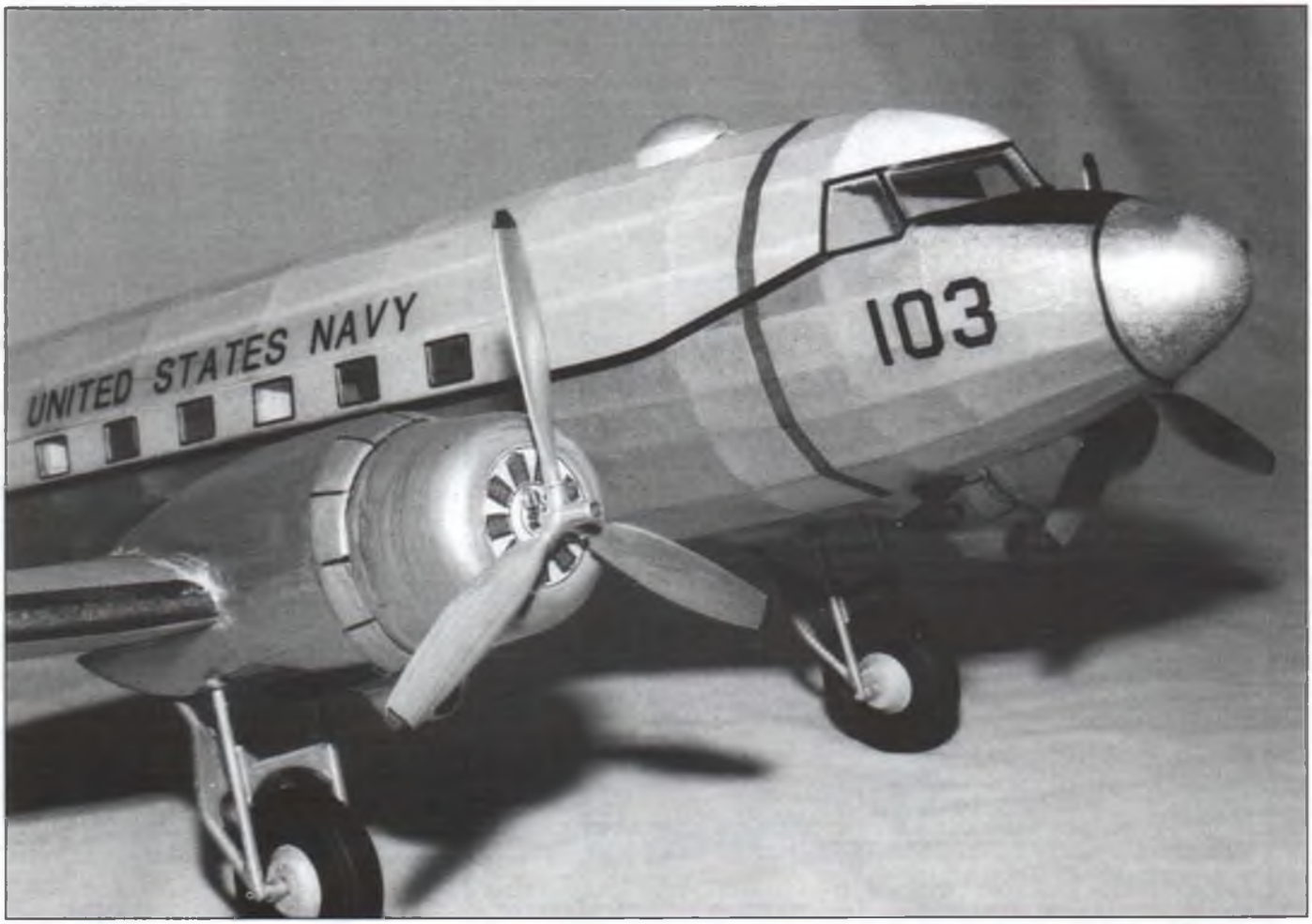
I'm a big chicken when it comes to flying in adverse conditions, so even though I brought my own plane, I decided to just take pictures and let the others brave the wind! The three of us have done a few of these school demonstrations, and I can tell you that they are very rewarding. Our schoolchildren are just like large sponges (but cuter); the kids are always eager to learn something new. The job is not hard or time-consuming, and you have the satisfaction of putting a smile on the kids' faces and knowing that they will run right home and tell anyone who will listen about their experience. Who can beat that?

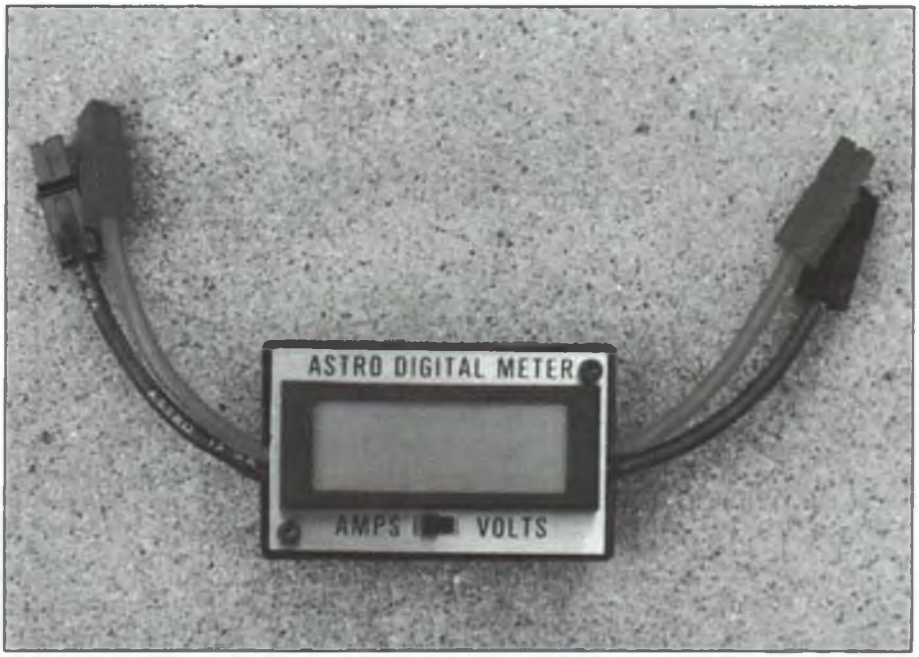
Those who fly geared electrics will like this: Windsor Propeller Co. has introduced a line of Master Airscrew Electric series wood props, featuring thin, undercambered blades. Should make for a noticeable increase in performance over an unmodified standard wood prop.

NEW PRODUCTS

My "New Products" file is filled up again, so let me tell you about some of the new items that have been introduced to the

For the FF electric crowd, ScienText offers a partial kit for this 39-inch span DC-3, pictured here in Navy markings. Details in text.





Now available, Astro Flight's new digital amp/voltmeter, a must-have piece of equipment for any serious electric enthusiast.

electric RC consumer. First, ScienText has added a new DC-3 electric free flight semi-kit to their already extensive product line. Full-size plans, templates and patterns are provided; decals for the U.S. Navy R4D-5 version are also included, but if demand warrants, decals may be made available for American, TWA or Eastern Airlines livery. The kit also comes with vacuum-formed engine nacelles, two 15-watt motors, propellers and wiring accessories. The price is $29.95 plus $2.95 S&H for U.S. orders from ScienText, 48 Whitney St., Westport, CT 06880-3753; (203) 221-1326.

I also received a sample of Windsor Propeller Company's new "Electric Wood" series propellers. These props feature wide, thin, undercambered blades and come in 11x7, 11x9, 12x8 and 13x8 sizes—perfect for a geared scale or sport model. Windsor notes that these props are intended for electric power exclusively, so don't try them with gas engines. They retail for around $4 each and should be available now at your local hobby store. If you can't find them locally, contact Windsor directly at 3219 Monier Circle, Rancho Cordova, CA 95742; (916) 631-8385.

Mike Anderson of Dry-Set Model Markings sent me a sample sheet of his company's dry transfer markings. These are not to be confused with common self-adhesive peel-and-stick decals, which have a clear carrier film that attaches to the plane along with the decal. Dry transfer markings come printed on a transparent carrier sheet and are transferred onto the model by laying the sheet in place and rubbing the desired marking with a ballpoint pen or a special burnishing tool. There is no carrier film left on the surface to detract from your trim scheme and fantastic finish. Available stencils include panel lines, rivets, hinge lines, screw heads, aircraft nomenclature (like "No Step," etc.), insignia and other special artwork. Write to Dry-Set at 7029 Sanger Ave., Woodway, TX 76710, or call (817) 741-0379 for a catalog.

At the 1994 IMS show in Pasadena, I saw the new Astro Flight Model 100 digital meter that measures voltage and current. That one was only a demonstration model, since they had not been released yet, but I found one at my local hobby store recently and snatched it up. This unit makes life so easy when testing motor and propeller combinations. It retails for around $55 complete with Astro Flight's "Zero Loss" connectors installed (I substituted Sermos connectors on mine, as those are what I'm using on all of my models), and is well worth the money. It should be available by now in most hobby stores.

CONTEST ANNOUNCEMENT

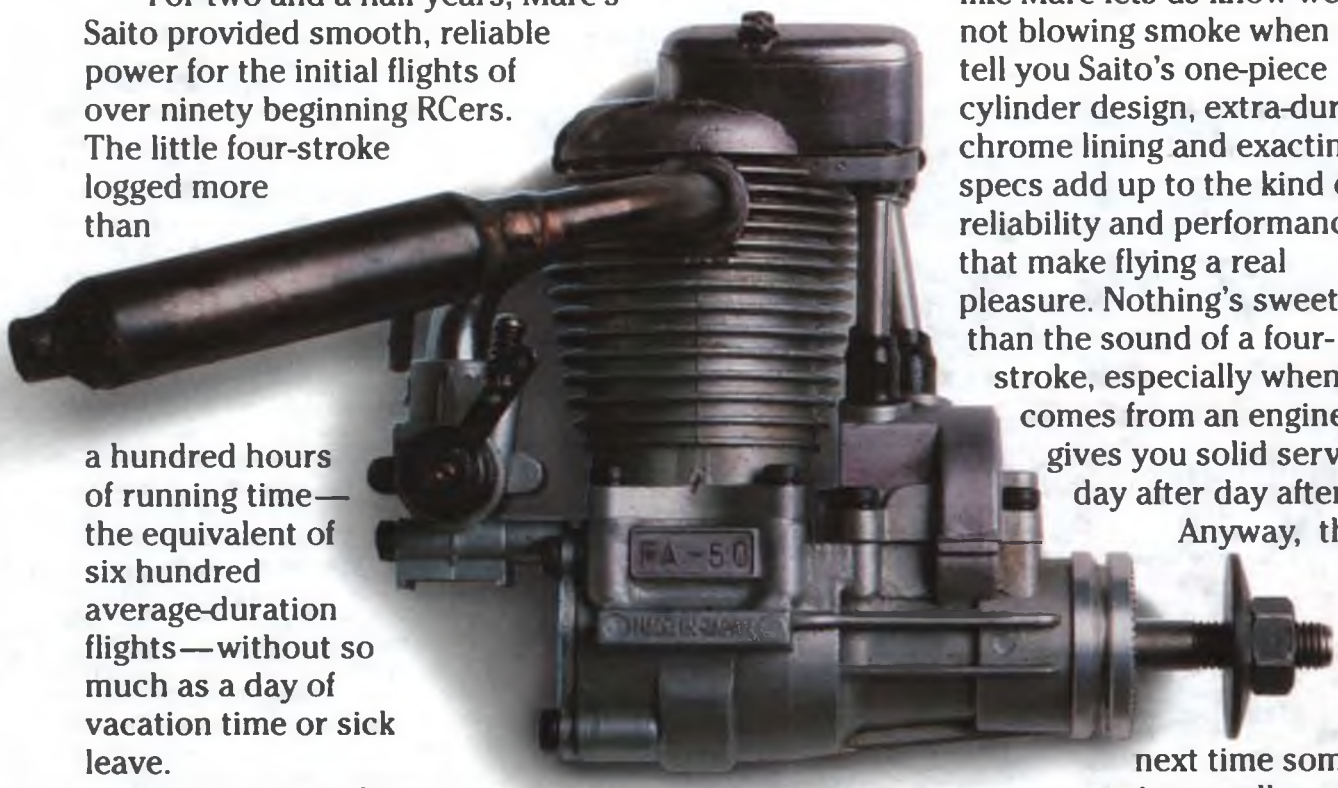
The Gulf States Electric Fly-In will be held on October 22-23 at the Louisiana Polo Field near New Orleans. This event is also a big draw for electric modelers from the south—last year's event was a tremendous success. Ben Mathews is organizing the event. If you would like to attend and need more information, contact him at 101 Mulberry, Metairie, LA 70005; (504) 833-5589.

So goes another month. I enjoy hearing from you, so please don't be shy about writing. I can be reached at 6462 Sunny Brae Dr., San Diego, CA 92119; (619) 463-4453 between 8 and 5 Monday through Friday, and also on CompuServ at 74164,3237. Internet users can send E-mail to me at 74164.3237@compuserve.com. ***MB***

Meet Marc Self's Most Reliable Employee.

In his spare time, Marc Self teaches RC flying near his hometown in northwestern Oregon. Marc's modest hourly fee includes the use of a plane and radio, and this is the story he told us about his most reliable employee—the Saito .50 that powers his primary trainer.

For two-and-a-half years, Marc's Saito provided smooth, reliable power for the initial flights of over ninety beginning RCers. The little four-stroke logged more than a hundred hours of running time—the equivalent of six hundred average-duration flights—without so much as a day of vacation time or sick leave.



Marc Self's two-and-a-half year old Saito .50, currently working on its second hundred hours of running time.

Then, just as the Saito was about to start on its twenty-sixth gallon of fuel, it appeared to lose power. Was this the end? Did this mean forced retirement for Marc's faithful employee?

Not a chance.

The engine showed virtually no sign of internal wear. Instead, its many hours of mid-throttle operation had merely resulted in an accumulation of carbon that restricted its breathing. So a quick cleaning had the Saito back on the job in no time, happily introducing even *more* beginners to the joys of RC flying.

It's always gratifying when someone like Marc lets us know we're not blowing smoke when we tell you Saito's one-piece cylinder design, extra-durable chrome lining and exacting specs add up to the kind of reliability and performance that make flying a real pleasure. Nothing's sweeter than the sound of a four-stroke, especially when it comes from an engine that gives you solid service day after day after day.

Anyway, the next time someone tries to tell you four-strokes don't make reliable everyday power- plants, tell them Marc Self's Saito .50 story. And tell them Marc has nothing but praise for his other Saitos, too.

Better yet, choose the Saito that's right for your next model and you'll be able to tell them *your* Saito story.

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Saito builds seven reliable single-cylinder and seven multi-cylinder four-stroke engines in displacements ranging from .45 to 3.25 cubic inches. Saito four-stroke engines are distributed exclusively by Horizon Hobby Distributors, Inc., 4105 Fieldstone Rd, Champaign, IL 61821

BIG BIRD GREMLINS!

Just when we thought we'd heard every excuse imaginable, Bruce comes along and says *gremlins* are responsible for the run of bad luck he's been having lately. What do you think?

The Gremlins have been up to mischief around the Big Bird hangar for the past two months and have done their best to do in a couple of projects and planes. The little devils first made their presence known when my Saito 300 quit running 10 minutes into a flight of my Stinger. I undershot the downwind leg of my dead-stick approach by what seemed liked miles, but was able to set it down parallel to the ground. This prevented any damage to the engine and demonstrated just how tough those R/C America composite landing gears really are.

Three Spacewalkers piloted by three Bruces. From left: Bruce Tharpe, Bruce Edwards and Bruce Sherrod. Photo was taken at the IMAA Chapter 323 fly-in Medford, Oregon.

The gear tore out of the fuselage around the area of the T-nuts along with a chunk of the 1/4-inch plywood landing gear plate. When the landing gear came off it took the right side of the horizontal stabilizer and elevator with it. The R/C America gear took the full force of the crash and all I had to do was bolt it back onto a new landing gear plate. An aluminum landing gear would surely have been bent up beyond repair.

Rebuilding the tail consisted of splicing a new stab half onto what was left of the old. After the parts were glued together, I took a 1-1/4 inch circular saw and on a plane horizontal to the stabilizer, sawed a slot partially through the splice. Then a 1/16 plywood piece was made to fit the sawn slot and glued into place, making the splice even stronger. So far it is proving to be a very sturdy splice.

The Gremlins were still working hard to make things difficult, though. After the Stinger repair, I decided to install my brand-new Walker/Sachs 4.2 for extra performance and save the Saito for a future scale project. (The Sachs 4.2 is about a pound heavier that the Saito but has over twice the rated horsepower.) To get familiar with the new engine, I first test-ran it in my trusty engine test stand. One flip of the prop and I had a start. I ran the engine several times for a total of about 30 minutes; hand restarts were easy.

I mounted the engine in the Stinger and wrapped all of the related components in foam rubber. This time, however, all attempts at starting the previously excellent running engine proved futile. I had spark and fuel, but could only get the engine to run (poorly) with the choke about 30 percent open. I spent an entire weekend troubleshooting that engine—no luck. By this time I was totally engulfed by Gremlin fog and my brain was about the consistency of a large bowl of lime Jello.

I called my good friend and mentor, Walt Wyrick, and after much sniveling, pried Walt out of his workshop. Walt went through the same motions I had gone through, with the same results—a non-running engine! We had spark at the correct time, so we knew the C.H. ignition system was OK. We had fuel and the engine was backfiring occasionally through the carburetor. We were really clutching at straws.

Walt was about to replace the carb with the one off his own Sachs 4.2 when I saw a light go on over his head. He suggested we try backing out the needle valves until the engine would run with the choke open. I had used the engine right out of the box and hadn't touched the needle valves because the engine had run so well initially. However, we did back out the needle valves and it worked. We soon had the engine tuned and again starting with one flip of the prop.

It sure is nice to have a knowledgeable friend to call on for some troubleshooting. Walt felt a certain amount of satisfaction from helping solve the problem and I certainly felt better because my arm was sore from so much prop flipping. I was determined to hand-start the engine even though I have two geared starters.

The Walker/Sachs 4.2 was running like a fine watch and I thought my troubles were over, but such was not the case. On the first flight the 4.2 pulled the Stinger into the air with authority. I made a turn into a shallow dive and suddenly experienced aileron flutter so severe that it broke off the aileron servo output shaft level with the top of the servo case! I went to retrieve the broken plane and found it damaged but repairable. The entire nose section was intact and the engine was unharmed. The propeller didn't even have a scratch on it!

I have yet to determine what caused the flutter. I had installed eight hinges on each aileron, used heavy-duty control horns, and the 3/8-inch pushrods had ball sockets at both ends. I've seen sloppy installations that are rock solid in flight, and I've now had personal experience with flutter in a precision installation of the ailerons and attaching equipment.

There are several different ways of mini-

mizing the possibility of aileron flutter. One of the most important is to use enough hinges on each aileron; I used eight large round Robart hinges on each aileron on my Stinger. You will also want stiff pushrods (the shorter the better) with a ball socket at each end. Obviously, the servos must be robust enough to handle a large control surface. If possible, the ailerons should be set up such that the control horn and servo are located about halfway along the aileron's length.

It's always a good idea to seal the aileron hingeline (or any hingeline on your plane, for that matter). One of the most effective fixes is to statically balance your control surfaces so that they will remain at neutral with the pushrod disconnected. It's usually not necessary to achieve full neutral balance to eliminate flutter, but you might as well do it right. I once eliminated aileron flutter in a Big Bee by using static balances based on a photo of an Extra 230 purchased from Scale Model Research. (Bob Banka provided a lot more than scale documentation in that particular case!)

BIG BIRD EQUIPMENT WAGON

Packing your Big Birds around isn't too tough if you own a pick-up or van, but when you arrive at the field it can be a real chore to get your planes and support equipment to the pit area and flight line. I've seen pilots and crews using various carts and wagons to carry their equipment, so I decided to make a ground support and equipment carrier of my own. I went to a local toy store and purchased a kid's Radio Flyer wagon with wood bed and side rails. The wagon has space for a starting battery, starter, fuel bottles, Ace Pro Panel, Hobby Lobby electric fuel

Bruce Graham's 92-inch Big Hots is powered by a Saito 270 and weighs 16 pounds. "Hot" is right!

■ LEFT: Cliff Sands' favorite biplane was a highly modified Fly Baby. It was powered by an A&M 3.7 Sachs and even had a tail gunner in the aft cockpit. We say "was," because one of the aileron servos failed and the plane was totaled. ■ RIGHT: Dave Desmond writes for a general aviation magazine when he's not flying RC. Dave's 1/5-scale Waco YMF-5 was built from the Pica kit and uses a Super Tiger 3000 for power. The plane has a 72-inch span and weighs 21 pounds.

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Here's a homemade plane hauler and ground power unit that will get your airplane and equipment to the pit area in grand style. See text for details.

pump, toolbox and plane rack.

The Ace Pro Panel simplifies fueling and starting procedures and can help determine if a glow plug is burned out or if the system is shorted. It allows me to clear a flooded glow engine, too. The fuel pump control uses a push-and-hold switch for fueling and an on-off switch to drain the tank. The push-and-hold switch should keep me from spilling much fuel when filling the tank.

FIGHTING FALCONS FLY-IN

With the ground power wagon finished, it was time for a shakedown cruise, so Eileen and I headed down to Medford, Oregon to attend the annual fly-in sponsored by IMAA Chapter 323—"The Fighting Falcons"—on July 2-3. Cliff Sands and crew made us feel right at home. At registration, each pilot was given a nice commemorative plaque and a colorful shirt, and each pilot and his spouse received tickets to the Saturday night barbecue.

This was a nice sized event, with about 35 pilots and 40 or so planes. I enjoy this size of fly-in because I'm able to interview each pilot in a leisurely fashion and still have time to fly. I'm sad to report that because of receiver failure, my Sig Spacewalker II was badly bent but will fly again. I passed out *Model Builder* T-shirts to Cliff Sands, Tom Dunnington and Bruce Sherrod for their contributions to Big Bird flying.

I was flying my Spacewalker II on Saturday when one of the pilots told my spotter that there were three Sig Spacewalkers in the air and that each pilot was named Bruce! Sure enough, I was flying my 1/4-scale Spacewalker II, and Bruce Tharpe and Bruce Sherrod were each flying their 1/3-scale Spacewalkers. Great fun!

BIG BIRD GOODIES

Horizon Hobby Distributors is offering its line of heavy-duty Hangar 9 servo wheels, made to fit JR, Futaba and Airtronics servos. The wheels are precision machined aluminum and have a classy gold anodized finish. Two styles are available: a solid disc drilled and tapped for ball link pushrod connectors, and a grooved version designed for pull-pull cable controls. Each style is produced in three different sizes. These wheels and arms are top quality and will not flex. They should give you years of service.

Horizon is the Saito distributor in the U.S., and Saito's latest engine, a 1.5 cubic inch four-stroke, is getting a good reputation. I recently phoned Dave Baxter, president of the Mount Rainier Radio Control Society, to find out how he liked the Saito 1.50 in his 1/4-scale Lanier Laser 200. The Laser is a spectacular performer with the Saito, and Dave says he's very pleased with both the engine and the plane.

Jerry Wall sent me a sample of his latest complete soft mount system for the Walker/Sachs 4.2 and 5.2 engines. In the past, Jerry had provided just the mounts—the mounting technique was up to you. Jerry felt his mounts might be better used if he provided the entire system. His samples look very good and should serve your soft motor mount needs very well. You can contact Jerry at J&L Enterprises, P.O. Box 1482, Forrest City, AR 72335; (501) 633-3101.

• • •

Bruce Edwards, 8304 53rd St. Ct. W., Tacoma, WA 98467; (206) 564-4416. ***MB***

Ace's Pro Panel does several jobs on Bruce's ground power wagon. The big 12-volt battery was later traded in for two smaller lawn tractor batteries.

PERFORMANCE

For almost 50 years Cox engines have provided legendary performance, from the smallest Tee Dee .010 for featherweight aircraft to the powerful Tee Dee .09. Developing specialty engines such as the Texaco .049 for duration, the Black Widow .049 for aerobatics and the Dragonfly .049 for 1/2A R/C sport has helped Cox maintain its leadership in small engine technology. We continue that tradition with the addition of the Tee Dee R/C 05 and 09 complete with throttle and muffler.

When competing in 1/2A Texaco events, smooth steady power and fuel economy is the secret to winning! The Cox Texaco features a high velocity venturi for improved fuel economy and a 5 fin cylinder head for extra cooling when swinging a big prop.

The 05 is based on the popular Tee Dee .051 Competition engine. This is the lightest engine available with true carburetor and muffler.

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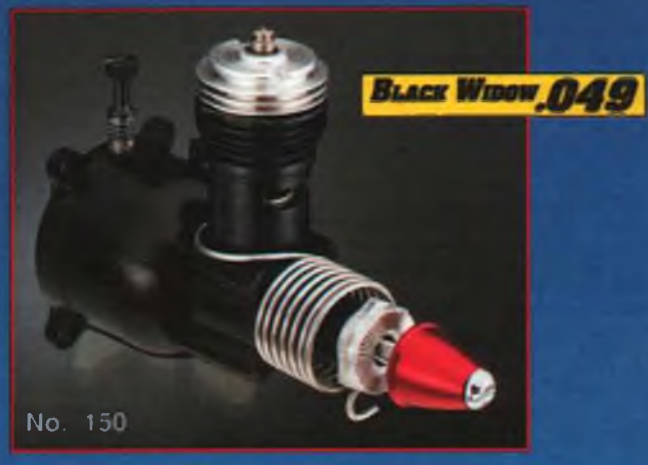
The 09 is a radio ready version of the powerful Tee Dee .09. The Tee Dee R/C 09 features true carburetion and muffler. Small size and weight allow the user to install this engine as a "Turbo-Boost" in most aircraft intended for 1/2A R/C flying.



First introduced in 1973, the Black Widow is our most powerful and popular .049 reed valve engine! It's great for all types of control line models including 1/2A Stunt, Mouse Racing, Beginner Combat and Powered R/C Sailplanes, too.

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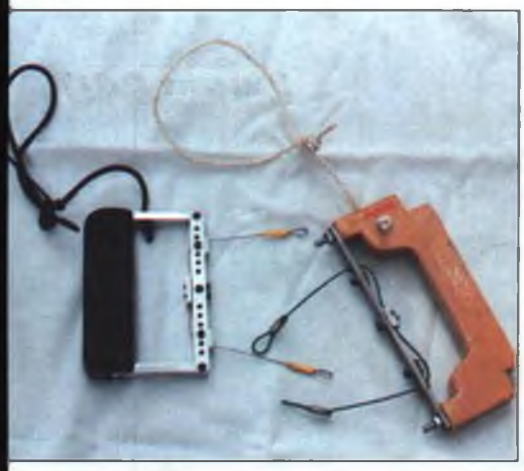
GETTING A HANDLE ON ... HANDLES

A properly designed handle with adjustable line spacing can make all the difference in the world when it comes to flight trimming a new model.

When we finish building a new airplane, the first order of business is to get it trimmed out. Trimming involves getting the plane to fly level upright and inverted, to turn equally in both directions, to turn sharp enough corners or corners that are not too sharp, to turn without hinging or yawing, to be stable in level flight, to glide well without power, and to have proper line tension—among other things.



■ ABOVE: The subject this month is handles; here are a couple of the better ones being offered. On the left is the one from Mark Wahlster, on the right is a homemade handle using the frontpiece from SST Specialty Products. More in text. ■ RIGHT: Morris Gilbert is usually too busy working at the Northwest Regionals to fly, but this year he found time to enter his Mustang in scale.

We have all kinds of things to adjust (before and after construction) in the search for perfect trim—leadout position, tip weight, engine position, elevator and flap travel, bellcrank size, flap alignment, and so forth. However, one of the most important (and often overlooked) trimming factors is way over at the other end of the lines: the handle. It's particularly useful for novice fliers to add this trimming trick to their repertoire.

The primary issue with a handle is line spacing—the distance between the lines. To a lesser degree, the position of the top and bottom lines can be used to solve some more subtle problems.

Many of the older or more traditional handles have no adjustments other than leadout length, which allows the pilot to find a neutral setting. Pilots using this type of handle solve the line spacing adjustment problem by switching handles. For example, a flier using one of the big old E-Z Just handles with the 5-inch spacing can tame a nervous airplane by switching to his equally old E-Z Just Hot Rock with its 4-inch spacing.

The paragraph above contains the key to the effect of line spacing on airplane performance: A big handle results in big control inputs, a small handle results in more subtle inputs.

With the superior aerodynamics of modern CL airplanes, the trend has been toward smaller handle spacing. Big handles generally provide too much control surface movement, resulting in planes that are hard to fly level, hard to guide smoothly through corners (if you're a stunt flier), and hard to aim (if you're a combat flier).

That's why we don't see the big E-Z Justs anymore, though the Hot Rock remains popular for those who can find them, and there are some very nice wooden Hot Rock clones now on the market, some of which have some degree of adjustable line spacing.

Until fairly recently, adjustable spacing in handles was rare. A notable exception was the Fox metal/wood handle, which offered the option of a 3-inch spacing in addition to the standard 4-inch setting. Racing pilots loved it, as they universally prefer a handle with narrow spacing to make their planes stable and eyes-off pointable.

However, there are applications in modern CL flying, particularly with regard to precision aerobatics and the finer styles of sport flying, in which more adjustability is desired than is offered by the switching from 3- to 4- to 5-inch handles. That's why handles with finer adjustments have become popular. It's now possible to buy handles with almost infinite adjustment over a certain range, which can help the pilot dial in the exact desired trim to a particular airplane.

One of the photos shows two of the currently available choices. I've flown with both handles and have been very pleased with the results.

The handle on the right, with the light-colored grip, was constructed from the handle frontpiece sold by SST Specialty Products. The frontpiece offers an infinite adjustment over its range, from about 1 to 4-3/4 inches. After buying the SST frontpiece ($27), it's up to the pilot to make his own wood handgrip, which is bolted to the frontpiece. This is an excellent handle for testing new airplanes, because it offers quick adjustment at the field over a wide range. My SST handle, including safety thong, came out weighing 3-3/4 ounces with a pine grip, finished with Hobby Poxy surfacing resin.

The handle on the left of the photo (dark grip) stopped your CL columnist in his tracks at the Northwest Control Line Regionals in May. It was a case of love at first sight; I bought mine within two minutes of first seeing it!

I was an easy mark because I was just then in the process of trying to find a handle that would feel comfortable, yet offer the narrow line spacing that seemed to be required by the stunt plane I had just begun flying.

The handle's maker, Mark Wahlster of Silverton, Oregon, had samples available at the Regionals. A knifemaker by trade, Mark brings superlative craftsmanship to the sideline of making handles.

He offers the handles in two sizes, with maximum spacing of about 5 inches on the large one and just under 4 inches on the small one. Minimum spacing is 1 inch. The design of the handle is such that the spacing can't accidentally slip during flight.

Wahlster's handles come with a safety thong and Allen wrench for adjustment. Among the nicest features are the soft, velvety grip and the generally compact and lightweight feel of the handle (only 2-1/2 ounces with safety thong and Allen wrench attached). The price of the handle, which comes ready to use, is $40.

As a general rule, fliers who find the control response of an airplane to be unsatisfactory—too sluggish or too quick—may want to consider starting their trimming process for this problem at the handle end before tinkering with the airplane. If an adjustment to the handle solves the problem, it could be quite a lot less trouble than an adjustment to the surface throw or balance of the airplane.

If the airplane is sluggish in responding to control inputs, try a wider line spacing at the handle. If the airplane is too quick turning or "nervous" in level flight, try a narrower spacing. Make small adjustments; you may be surprised how much effect the changes in spacing at the handle will have.

To order SST handles, or to obtain more information, write SST Specialty Products, 28746 Westfield, Livonia, MI 48150 (be sure to ask for their catalog, which offers mufflers, bellcranks, header gaskets, control horns, venturis and other products). Wahlster handles can be ordered from Mark Wahlster, 1404 N. Second St., Silverton, OR 97381.

CONTEST NEWS

Here in the Northwest, the contest season as usual hit its high point with the 23rd annual Paul Agerter Northwest Control Line Regionals in Eugene, Oregon.

With 40 events and 123 trophies, the Regionals is always the top draw in the region. The central location of the site at Eugene Airport makes the three-day contest pull in competitors from all over the western U.S. and Canada. Every event in the AMA rulebook (except endurance) and nearly all of the regional Northwest events are run at this contest.

■ LEFT: First place in precision scale at the Northwest Regionals went to Grant Heistand's huge 1/3-scale, *electric powered* Spacewalker—probably modified from the Sig kit.
■ RIGHT: Kirsten Walker, 8, following in the footsteps of her father, World Champion Paul Walker, is a budding stunt flier. She flew a Flying Clown in beginner precision aerobatics at this year's Jim Parsons Memorial Stuntathon in Kent, Washington.

Jeff Rein was unbeatable in combat at the '94 Northwest Regionals in Eugene, Oregon. He won 1/2A, fast, slow and 80-mph combat without losing a match!

The typically changeable spring weather was a factor in the '94 meet, with sunburn conditions on Friday and periodic showers during the rest of the weekend, and even a bit of wind to make the aerobatics flying an extra challenge.

This year's contest featured a couple of new events. One, 21 Proto Speed, drew only one entry, Chris Sackett, but his several test flights were a good demonstration of the event's possibilities. The other new event, 80 mph Combat, under a new set of Northwest rules, also proved to be a successful demonstration of an event that could become quite popular. The new combat event replaced Fox .35 Combat on the schedule.

Also worthy of note from the combat circle: Jeff Rein brought his broom along and swept the four combat events, going entirely undefeated along the way. In the scale showcase, Grant Heistand, who is in real life an animator for Disney studios, flew a 9-foot span electric-powered model of the Sig Spacewalker in precision scale. Frank Hunt III roared to a national B Speed record of 179.95 mph.

The precision aerobatics community was treated to performances by three fliers who will represent the United States at the World Championships: Ted Fancher, David Fitzgerald and Paul Walker. On the down side, not one but two beautiful precision aerobatics models folded under the stress of the windy conditions on Sunday.

The Saturday night banquet drew more than 100 people for the usual banter, door prizes and aviation-related program, which this year featured a Vietnam War pilot's tales of his dramatic war flying experiences. On display and the subject of quite a bit of interest was the modified Veco Chief used by the Eugene Prop Spinners to set the record of a single flight of 64 hours, 33 minutes and 14 seconds way back in 1957. Not only was the plane on hand, but one of the Prop Spinners who was involved in the flight, Morris Gilbert, was there to answer questions.

After the intensity of a major three-day contest, it was a joy to travel a couple of weeks later to Kent, Washington for the relaxed atmosphere of the annual Jim Parsons Memorial Stuntathon.

This year's Precision Aerobatics portion of the contest was flown in two rounds. The first round was the standard AMA pattern. In the second round, advanced and expert contestants had the option of choosing the regular pattern, a reverse pattern, or Paul Walker's special pattern. There was a bonus K-factor for the reverse and special patterns, with the two rounds added for a final score.

A final item worthy of note at both the Regionals and the Stuntathon: World Champion Precision Aerobatics pilot Paul Walker appears to be grooming a successor for the future. His eight-year-old daughter, Kristen, already is displaying a flair for aerobatics, competing in beginner precision aerobatics in both contests at the handle of her Flying Clown. Look out, experts!

• • •

Questions, club news, contest information and reports, photographs, technical tips, and other information of interest to CL fliers is welcomed. Write John Thompson, 295 W. 38th Ave., Eugene, OR 97405. E-mail at 73473.1407@compuserve.com. ***MB***

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Close-up of charger panel shows one possible arrangement of the controls. All of the lettering is done with rub-on labels available at electronics stores, then sealed with two coats of clear Krylon—makes for a really professional appearance.

A DO-IT-YOURSELF ELECTRONICS PROJECT

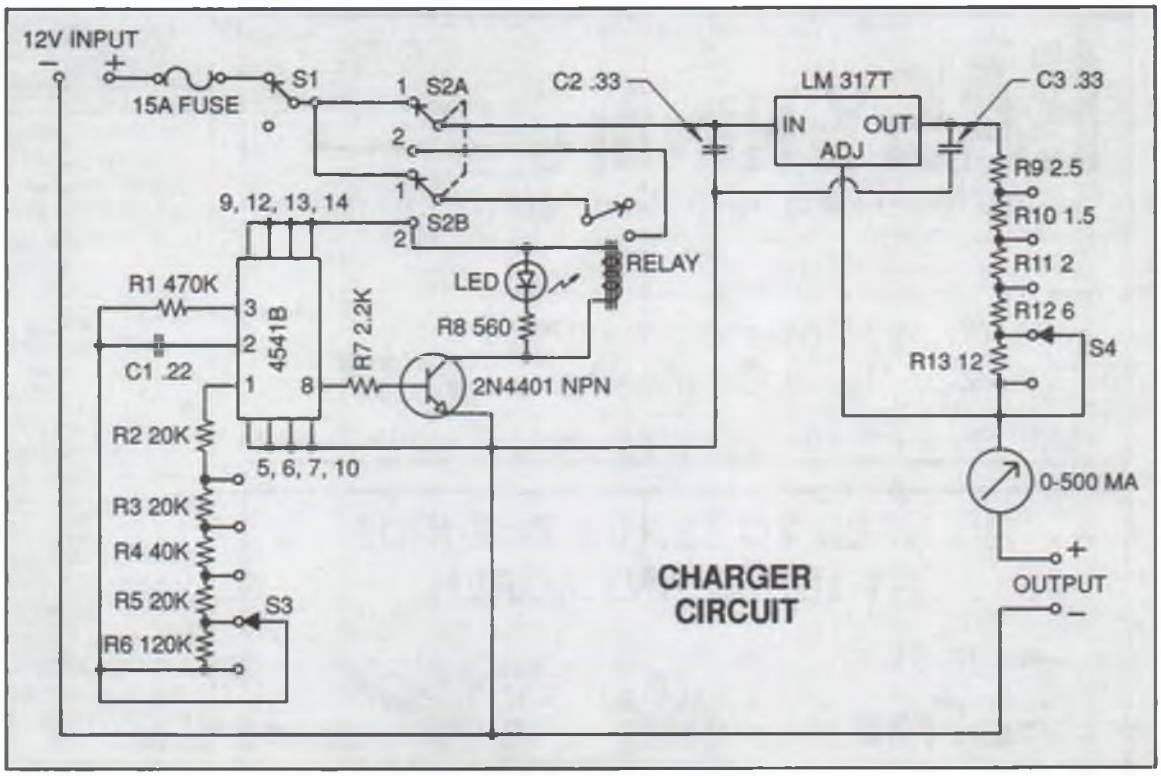
A CONSTANT CURRENT CHARGER WITH BUILT-IN ELECTRONIC TIMER

Sooner or later, everyone who flies RC will wish they had one of these. Designed for field charging airborne RC packs from a 12-volt battery, this handy unit is inexpensive and easy to build, even for those with little electronics experience.

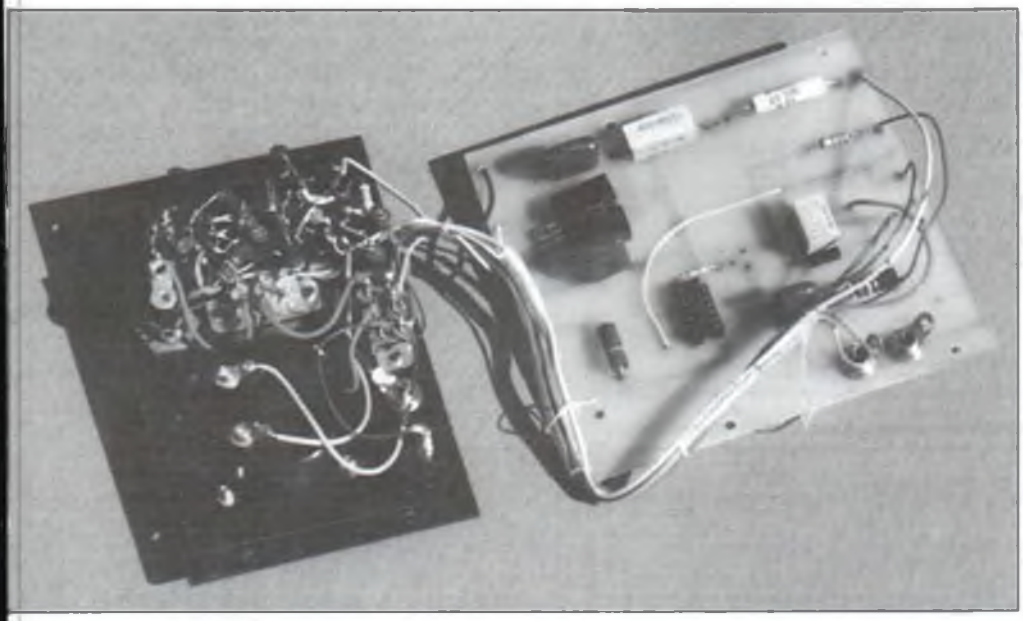
If you do much flying, chances are that more than once you've wished you could charge your airborne batteries on the field. Furthermore, you'd like to do so in a way that allows you to talk to your friends, visit the moon-door house or eat your lunch without having to monitor the process. You want to "plug in and forget."

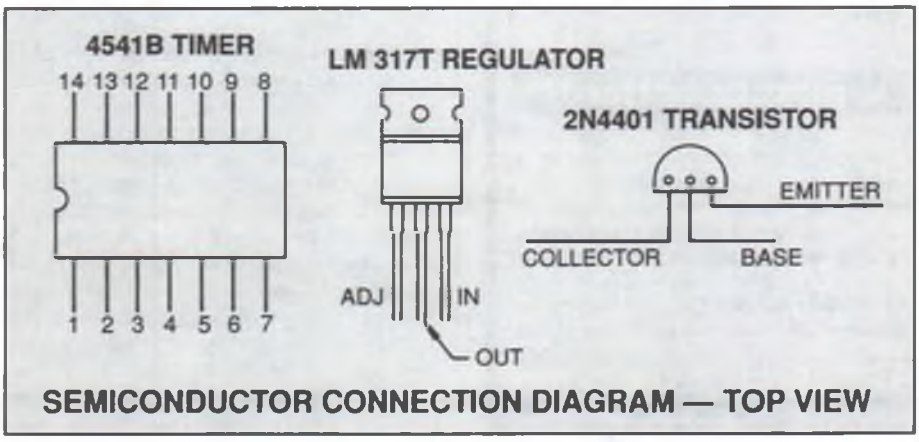
The charger described here is simple and reliable and inexpensive to build. To use it, plug in your airplane via a charging cable, switch the unit

BY JOSE M. TELLEZ



Awaiting assembly, the front panel on the left and circuit board on the right; wiring connects the two. The two halves will be joined by means of spacers at the corners. Just for fun, the author etched his own single-sided PC board, but point-to-point wiring on a .1-inch spacing perforated board will do just fine.





PARTS LIST

RESISTORS

- R1 470 ohms 1/4 watt
- R2 20K ohms 1/4 watt
- R3 20K ohms 1/4 watt
- R4 40K ohms 1/4 watt
- R5 20K ohms 1/4 watt
- R6 120K ohms 1/4 watt
- R7 2.2K ohms 1/4 watt
- R8 560 ohms 1/2 watt
- R9 2.5 ohms 2 watts (or larger)
- R10 1.5 ohms 2 watts
- R11 2 ohms 1 watt
- R12 6 ohms 1/2 watt
- R13 12 ohms 1/2 watt

CAPACITORS

- C1 .22 microfarad 25 volts
- C2 .33 microfarad 25 volts
- C3 .33 microfarad 25 volts

SEMICONDUCTORS

- LM 317T regulator
- 4541B timer
- 2N4401 NPN transistor
- LED (light emitting diode)

MISCELLANEOUS

- (1) Heat sink for LM 317T (TO220 package)
- (1) 0-500 milliampere meter
- (1) Fuse and fuse holder
- (1) RCA jack
- (1) 14-pin DIP socket for timer chip
- (1) 12 volt miniature relay SPDT
- Material for front panel (Bakelite or equivalent)
- Material for circuit board (.1-inch perforated board or PC)
- Assorted machine screws and nuts

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on and select the desired charge rate (50, 100, 200, 300 or 500 milliamps). Next, decide if you want to time your charge manually or automatically. For the latter, select the duration of the charge—5, 10, 20, 30 or 60 minutes—and flip the mode switch to the timer position. An LED indicates the charge is taking place. The meter will verify the rate selected, and you can now go happily about your business. When the charge is complete, the unit shuts off automatically.

With the mode switch in the manual position, the unit will charge your airborne pack at the rate selected for as long as you leave it hooked up—or until you run down the battery in your field box!

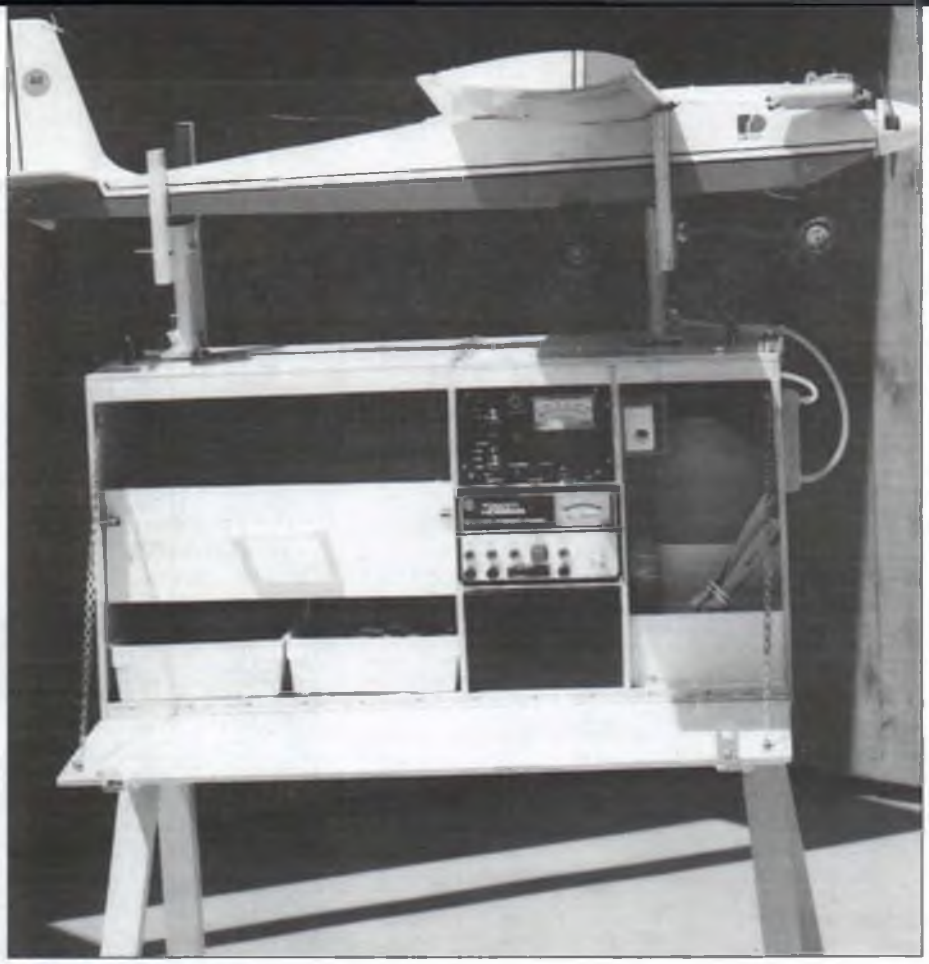
The circuit consists of two parts: charger and timer. The charger is based on an LM 317T regulator chip hooked up as a constant current device. This device is designed such that when a resistor is inserted between its output and adjustment terminals, the voltage between these terminals is kept at a constant 1.2 volts. In our case, the value of this resistor can be selected for the current values mentioned above.

The milliammeter shown in series with the charger output is a nicety more than a necessity. The switch position shows the charging current, but I still like to actually *see* the current going through the leads. Besides, the meter looks quite classy.

The output jack is an RCA audio jack. These are inexpensive and for years have provided reliable service in all of my charging gear.

The timer circuitry is based on a 4541B timing device, which controls a relay. When the charger is in the automatic mode, it can receive input power only when the relay is in the energized position. The 4541B has an oscillator section which we control by means of an external capacitor and a resistor. The second part of the device is a counter, which in our case is hooked up to count 65,536 cycles of the oscillations generated. If we generate an oscillation where each cycle has a duration of .001 second (1,000 cycles per second), the counter will count 65,536 times .001 second = 65.5 seconds and then turn off the relay. Simple! In our case, we've used a fixed capacitor (C1) with a value of .22mfd and a string of resistors (R2 through R6) for charge times of 5, 10, 20, 30 and 60 minutes.

My own charger is built on a 5-1/2x 3-1/2 inch Bakelite front panel and a 4-1/2x5 inch circuit board spaced about 2-1/2 inches behind the panel. Resistor strings R2 through R6 and R9 through R13 are mounted directly onto rotary switches S3 and S4. The master switch (S1), mode switch (S2), fuse, LED, milliammeter and the output jack are mounted on the front panel. The circuit board holds the two semiconductors, the relay, transistor, three capacitors, resis-



The charger installed in the author's field box above a Tower Hobbies power panel.

tors R1, R7 and R8 and that's all, making it very simple to lay out. The circuit board is tied to the front panel by a number of wires, which should be left long enough such that the two can be laid side-by-side while wiring and then joined by means of long machine screws and spacers.

A frequent pitfall is wiring the semiconductor devices backwards, therefore I've provided a base connection diagram for them. Note that these are viewed from the top, which means from the parts side; the wiring side will be a mirror image. Also pay attention to the notch on the 4541B chip. The proper orientation of this notch is essential. Relays come in many different base configurations; you should find a diagram printed directly on the relay case. Wiring the relay incorrectly won't damage it, and if you do make an incorrect connection of the contacts, it's easy to switch them around.

Because of its susceptibility to damage by static electricity, I strongly suggest you use a 14-pin socket for the 4541B. This way, you can complete all the wiring on the socket and only then insert the semiconductor in the socket.

The LM 317T regulator should be mounted on a small heat sink as an extra precaution for long life, even if it's dissipating very little power and is internally pro-

continued on page 40

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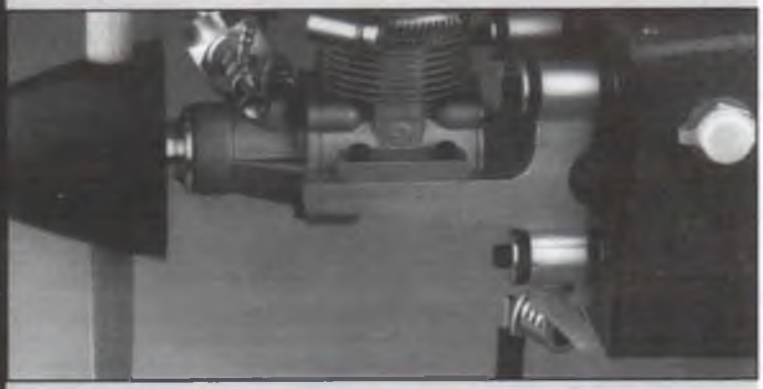

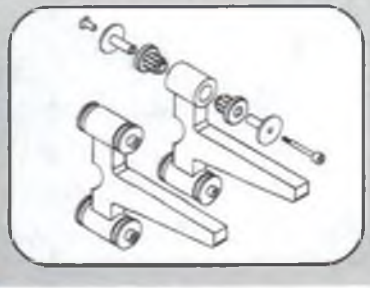

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FREE FLIGHT

BY BOB STALICK

• Bill Lynch's Sidewinder F1J
• Holland Hornet Needle Valve Mods
• Handy Hints

When I was much younger, I thought art was something produced by others who understood what they were doing. I also had a very limited view of the meaning of art. To me, the term "art" meant paintings or sculptures. It took awhile for me to conceive of art as moving or transient—perhaps just a fleeting moment, an event of singular magnitude, a personal experience with beauty.

So it is with free flight. Although all of us admire the exquisite craftsmanship of a well-constructed geodetic framework or a perfectly silked or tissued Old Timer, the flight is the thing. We can recall, usually with vivid description, THE FLIGHT. The memory of THE FLIGHT is what hooked us on free flight, and each of us has been attempting to recreate that flight again and again as we launch model after model into the sky.

I recall my own personal artistic experience with THE FLIGHT. It was at Harts Lake Prairie, Washington, during the Jim Walker Memorial Free Flight Contest in 1962. I was flying an A-B Spacer in B Gas. The engine was a Fox .201. The model was flying on rails, getting way into the air for max after max. I won the event—my first ever 1st place trophy.

In truth, the flight was probably not as perfect as I recall, and I have undoubtedly had much better performances in the years since, but the memory serves as inspiration. Perhaps that is the essence of art. It's the inspiration to keep trying, to keep aiming for elusive perfection.

NOVEMBER THREE-VIEW: THE SIDEWINDER F1J

Bill Lynch has been the premier promoter of the F1J event here in the U.S. With his growing stable of winning designs, Bill has raised the level of F1J performance to new standards. In addition to his involvement in the design of models, he also imports the state-of-the-art AD .06 and has marketed a large number of custom F1J hardware.

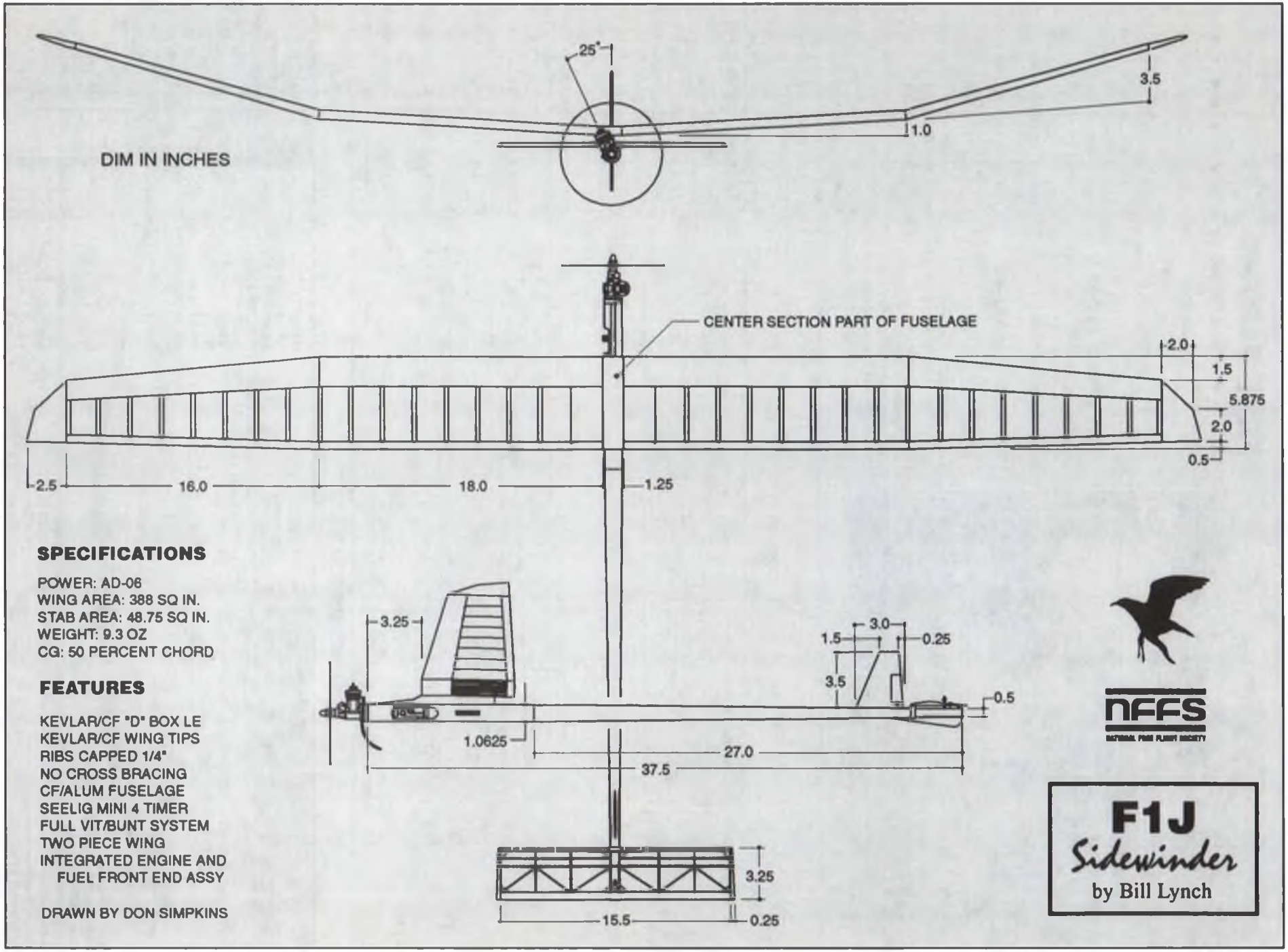
The Sidewinder is the latest in Bill's F1J designs. He writes: "Several test sessions with the Pegasus revealed that it didn't like really turbulent air. Its high aspect ratio and modest dihedral made it great for average conditions, but the model became less stable in gusty, turbulent conditions. I decided that a model to meet these sometime conditions was in order.

Although all of us admire the exquisite craftsmanship of a well-constructed geodetic framework or a perfectly silked or tissued Old Timer, the flight is the thing.

"Sidewinder is the result. This model was completed in time for the 1993 Sierra Cup. Both Pegasus and Sidewinder were ready, but windy, gusty conditions pointed to Sidewinder. It flew very well, but a terrible launch in the flyoff cost me a third straight Sierra Cup win."

All of the parts noted in the drawing are available from Bill or other free flight suppliers. If you're interested in the Lynch Competition Systems Catalog or the full-size plans for either the Pegasus or Sidewinder, contact Bill Lynch at 11137 Creekhaven Ct., Auburn, CA 95602. Enclose $1 for the cata-

Bob Hatch readies his 300 square inch 1/2A ship for an official flight. Design is by John Ferrer and is a consistent performer with a Tee Dee .049 or .051. Photo taken at Harts Lake Prairie, Washington.



SPECIFICATIONS

POWER: AD-06
WING AREA: 388 SQ IN.
STAB AREA: 48.75 SQ IN.
WEIGHT: 9.3 OZ
CG: 50 PERCENT CHORD

FEATURES

KEVLAR/CF "D" BOX LE
KEVLAR/CF WING TIPS
RIBS CAPPED 1/4"
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TWO PIECE WING
INTEGRATED ENGINE AND
FUEL FRONT END ASSY

DRAWN BY DON SIMPKINS

F1J Sidewinder

by Bill Lynch

FREE FLIGHT

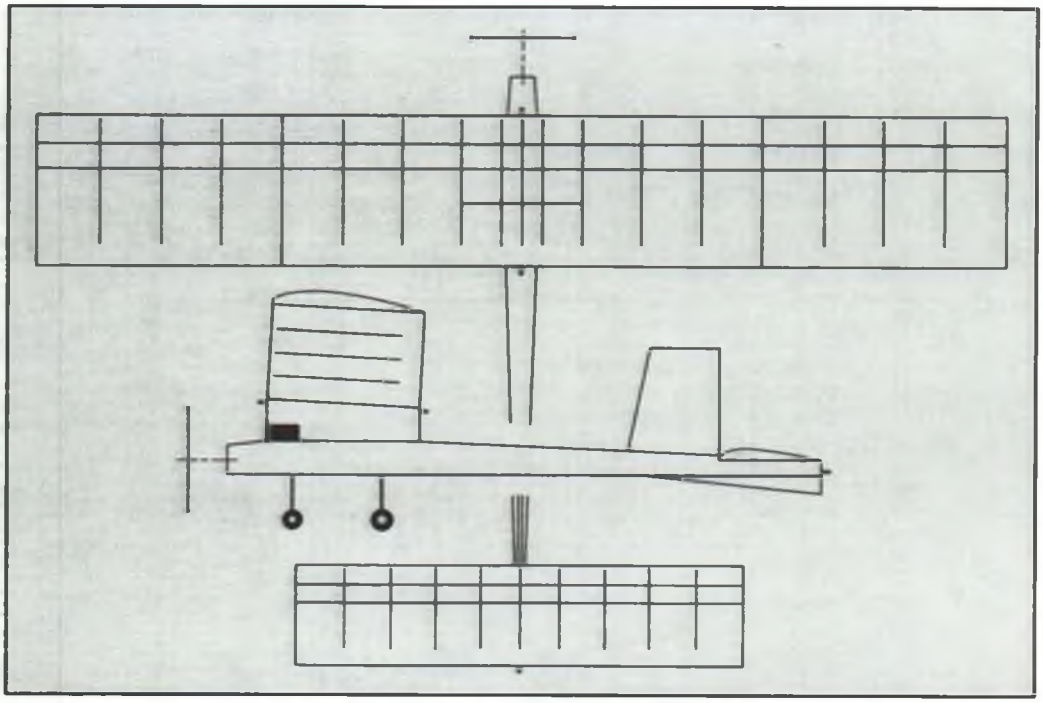
Tony Saunderson (left), with plenty of help, prepares his K&B powered Class C GYSOB (*MB* Plan #7763) for a flight at a recent Harts Lake Prairie Contest.

log or $15 for the plans.

NOVEMBER MYSTERY MODEL

One event that continues to intrigue me, even though I've never competed in it, is Cargo. The rules are simple: Use an .020 engine and a wingspan not over 48 inches, rise off ground with a 20 second engine run and 40 second flight time carrying as much weight as you dare pile on. The winner is the one that hauls the most weight. Sounds simple, but the truth is less simple. I've watched experts at regional and national events struggle repeatedly to succeed with these simple rules.

This month's mystery model once won the AMA Nationals Cargo event for all age classes. It was designed by a very well known free flighter, who is still active in indoor competition today. Know what it is? Send your guess to *Model Builder*. The winner will be drawn at random from among the correct entries and gets a free one-year *MB* subscription. Great deal. Act now.



NOVEMBER MYSTERY MODEL

AUGUST MYSTERY MODEL WINNER

We had one wrong guess apiece for three Sal Taibi designs—the Cadet, Comet and Zephyr—but 13 others correctly responded with Sal Taibi's "Zenith," as published in M.A.N., *February 1952. The airplane was flown with both wheels and floats, and was noted for its 1st place win in Class A Gas and 2nd place in Class A R.O.W. at the 1951 Nats in Dallas. The free* MB *sub goes to Richard Drake of Garden Grove, California.*

HOLLAND HORNET N.V. MODS

One of the shortcomings of the otherwise superb Holland Hornet .049 and .051 engines

continued on page 78

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Wing loading 3.8 oz. sq. ft.
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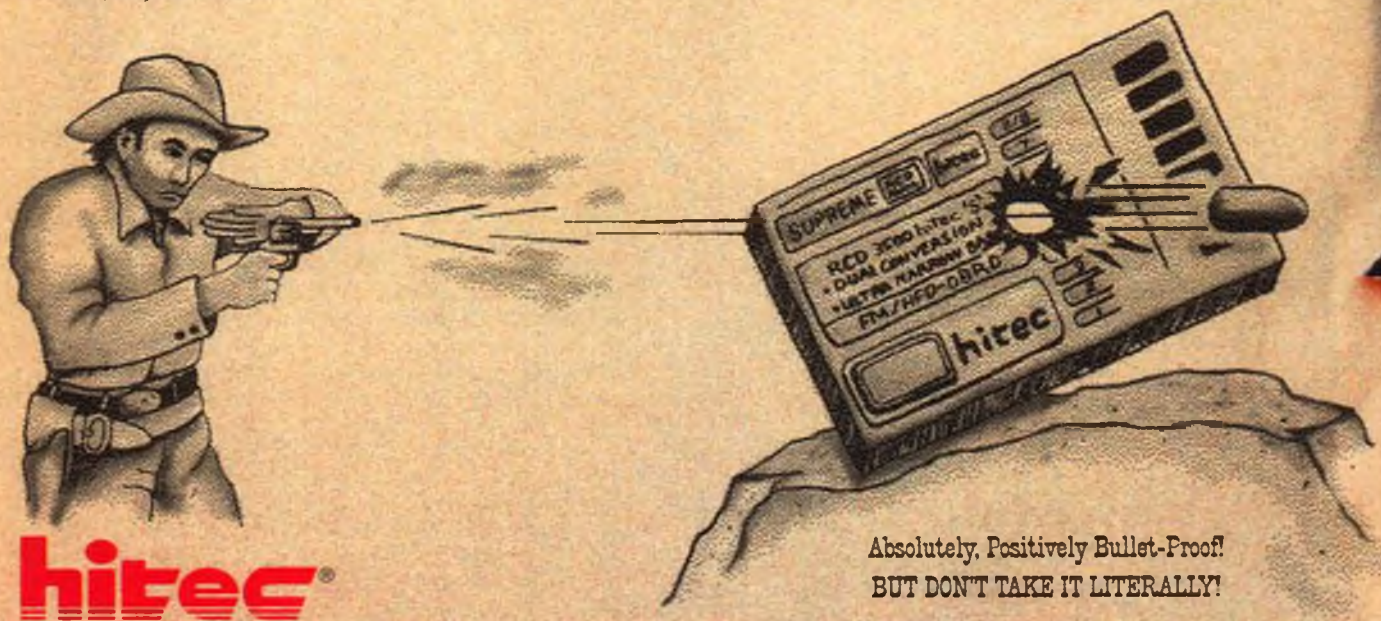

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	Servo Type	# of Servos	Size in Inches H x W x L	Wt. Oz.	Stall Torque	Speed 60 DEG @(4.8V)
SPORT PACK	HS-300	4	1.4 x 0.8 x 1.6	1.57	42 oz."	0.19 Sec
PRO-PACK	HS-422	4	1.4 x 0.8 x 1.6	1.60	43 oz."	0.20 Sec
ELECTRO-GLIDE	HS-101	3	1.2 x 0.5 x 1.3	0.93	24 oz."	0.20 Sec
GIANT PACK	HS-700	3	2.0 x 1.1 x 2.3	3.60	133 oz."	0.22 Sec
(w/1 std. servo)	HS-422	1	1.4 x 0.8 x 1.6	1.60	43 oz."	0.20 Sec
SUB-MICRO PACK	HS-80	3	1.1 x .05 x 1.1	0.62	31 oz."	0.15 Sec
SUPER PACK	HS-605	3	1.5 x .08 x 1.6	1.73	77 oz."	0.16 Sec

HANNAN'S HANGAR

BY BILL HANNAN

"If you live long enough to learn all the rules, you may be too old to play the game – except in model building!"

Our lead-in quotation was slightly modified from a telephone comment made by contributor George Benson.

READERS RESPOND

A most rewarding part of conducting this column is reading feedback mail from regular readers, and here are a few extracts:

Read Johnson, of Palos Verdes Estates, California, wrote: "I especially liked the photos of the world famous model builders' work areas (July '94 *MB*). It is easy to see why they turn out superb models, as their workplaces reflect the precision and neatness that go into their finished products. They even inspired me to clean up the corner of the garage in which *my* balsa chips fly."

Jack Delahunty, of Oil City, Pennsylvania, said how much he enjoys the current *Model Builder* format: "I find I am becoming a collector of plans, perhaps more so than a builder. This of course includes reduced reprints and three-view drawings. Your articles have helped me realize that I see and appreciate them as a form of art, representative of man's ingenuity. They are created through education, mental discipline, integrity, respect, sharing, and craftsmanship." Jack laments that such qualities seem less prevalent in our present "instant gratification" oriented society.

However, Bill Kincheloe recently loaned us an aviation book which expressed the following sentiment: "In light of events during recent years when shiftlessness and indolence seem to have received officially the stamp of great virtue, it should be especially refreshing to read of an earlier period when young men were taught that honesty, hard work and sincerity of purpose brought just rewards." Sound familiar? You may be surprised to learn that statement was part of a tribute to the Wright brothers, in an editorial which appeared in *Aerosphere* for 1943! Some things never change.

How's this for a sturdy model workshop? Mike Hetherington, of Derbyshire, England, builds his delicate flying scale models in this castle-like chamber, which dates back to 1086! Mik Mikkelson photo.

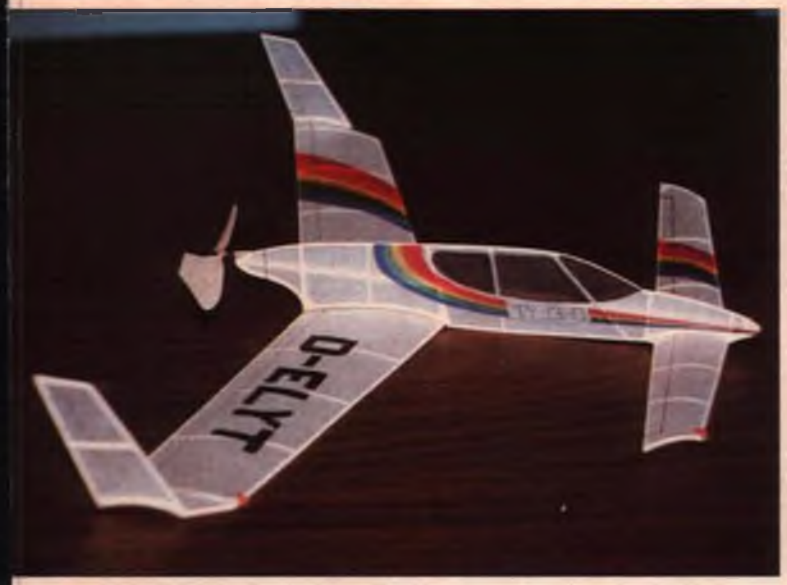
How to turn a Junior on to models—let him handle one, or better yet, let him fly it! See the pride in the face of young Eric Horton, as he holds his grandfather's P-38. Dan Walton photograph.

BOO-BOO DEPT.

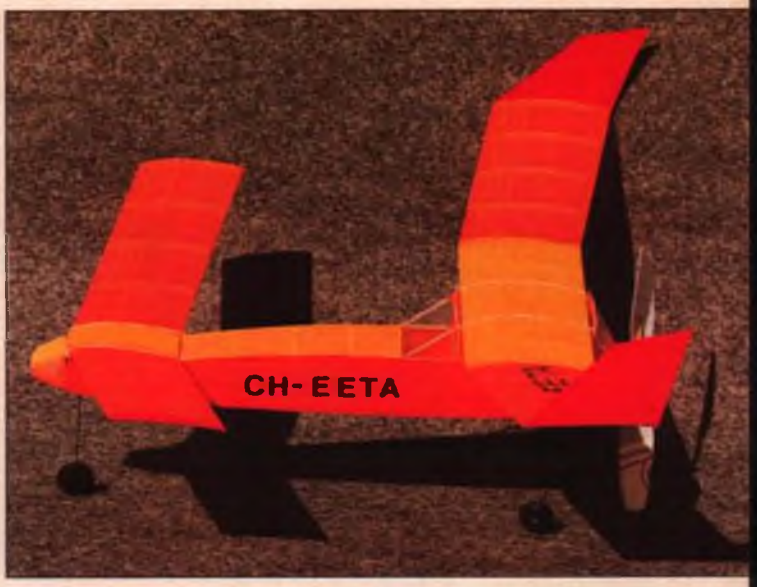
Some photo caption errors cropped up recently: In our July column, the in-flight shot of Dave Aronstein's rubber-powered ducted-fan Panther should have been credited to Carl Stokes; and the MiG-15 model by Kazuhiro Suzuki weighs only 4.9 grams, not 14.9 grams. Also, in our August '94 column, the photo of Tom Hallman with his Martinsyde biplane came to us from Tom Sanders of the Skyscalers club, not Tom Danders of the Skysailers. Apologies all around.

GEE BEE GRAPEVINE

Model builder Vern Clements' daughter, Jeannie, attended the Truckee/Tahoe (California) airshow, where Delmar Benjamin was performing. When Delmar asked Jeannie is she might like to sit in his Gee Bee R-2, she eagerly accepted. Delmar closed the tiny side door, then got busy autographing T-shirts for customers. Jeannie was afraid to touch anything, so about 10



Carl Stokes' fine photo of David Aronstein's No-Cal scale "Gyroflug E-401" canard, which is an excellent performer.



Another canard/tandem wing design, this one a Bostonian, by George Benson, of Mill Valley, California.

minutes later, when Delmar returned and opened the door, he asked: "Are you fried?" Jeannie's thoughtful reply: "Just well done!"

A few days later Delmar was in new Hampshire, birthplace of the Granville brothers, taking part in a special airshow tribute to the Granville family, according to modeler Henry Haffke. Although inclement weather forced cancellation of flying the first day, the Granvilles and their friends gathered in a hangar around Delmar's Gee Bee and had a great time sharing reminiscences. Later, in a hotel conference room decorated with air racing memorabilia, another celebration took place. Among the participants were builders of full-size Gee Bee Y and Z reproductions, currently in progress.

Happily, the weather was favorable the next day—one the Granville family will long remember. Haffke explained: "A VIP tent had been arranged right on the flight line, for the Granville family and friends. We pushed the Gee Bee from the hangar down the taxiway to the tent. Bob Granville's sons Bob Jr. and Lee, Dick Blakely and I helped Delmar push the aircraft, and I told him he was in good shape for the day, having actual Granville brothers in his crew."

After Delmar opened the show with a short flight, New Hampshire state dignitaries presented commemorative plaques to the Granvilles. Then Delmar performed a longer routine, wowing the crowd with his low-level inverted pass, before heading for his next destination.

David Gee designed this "Boston-Paul Defiant" Bostonian. Note the subtle humor in the ID letters and roundel.

SLIPPERY STUFF

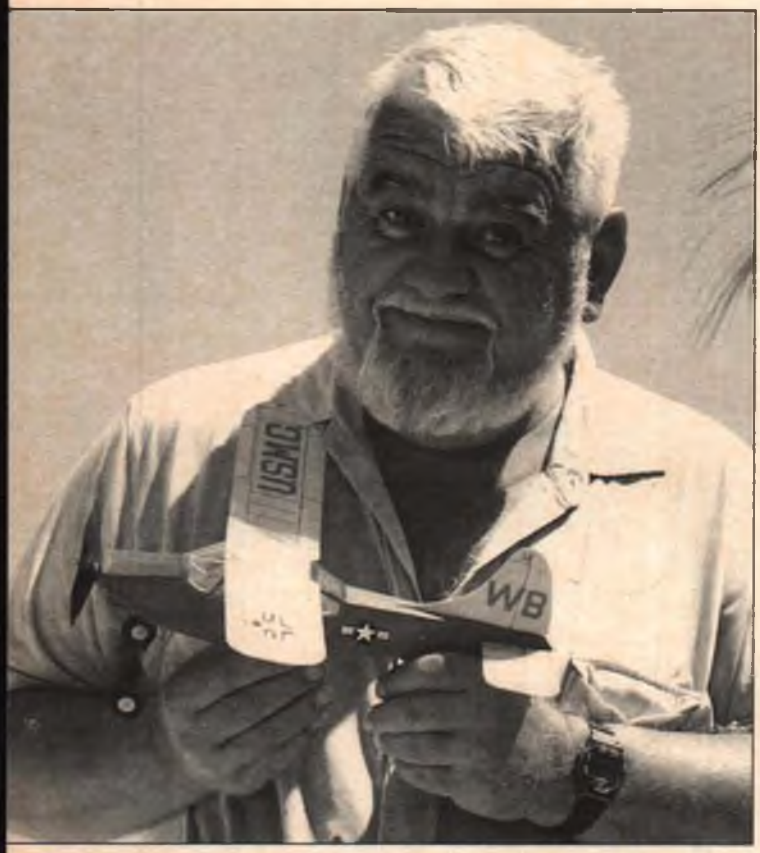
Bernie Coyner, of Solvang, California, recommends Plumbers' Silicone Lubricant WG-1, available from hardware stores, for rubber motor lube. At about $3 for a 1/2-ounce container, it may seem pricey, but not much is required to lube small model motors. Bernie places a pea-size dab of it in a plastic sandwich bag, drops in the already-tied rubber loop, and massages it through the bag until the rubber is well lubed.

NEW ITEMS DEPT.

• Model historian Jim Alaback has compiled a useful list of Old Timer modeling resources, featuring addresses of O.T. organizations, O.T. publications, as well as sources for back issues of magazines, old O.T. article copies, model kits, plans, engines, parts, supplies and accessories. Jim asks $1 and a stamped pre-addressed return envelope for the list—and also solicits additions to it. Jim Alaback, 12366 Nacido Dr., San Diego, CA 92128.

• Al Lidberg offers new additions to his line of reduced-size versions of such well-known O.T. designs as the Brooklyn Dodger, Miss America and Wedgy, as well as nine earlier releases. All are intended for CO_2 or electric power, with details of either option detailed on the plans. The semi-kits have printwood, instructions and a list of sources for remaining parts. A 16-page catalog of the semi-kits and many plans of wide variety is yours for $1.50 from A.A. Lidberg, 1008 E. Baseline Rd., Suite 1074, Tempe, AZ 85283.

• *Twenty-Seventh Annual Symposium of the National Free Flight Society, 1994* is the imposing title of a most compre-



Jake Larson, who produces more models than any six average model builders, shows his lightened version of an old Carl Goldberg kit Stinson L-5.

hensive collection of articles and plans. Edited by the irrepressible Bob Meuser, the book is a mixture of highly technical theory, balanced with less esoteric presentations. Among the subjects examined are thermals, how an airfoil produces lift (and how it doesn't!), drag reduction, turbulation and boundary-layer control, timers, glider trimming, model stability, engines, ornithopters, Meuser's own "The Design of the Stealth Bomber" (certain to raise politically correct eyebrows), and much more. Plus Dr. Will Nakashima's great cartoons.

The *NFFS 27th Symposium* is available to NFFS members for $20 (non-member price is $24), plus $2.50 postage, from Fred Terzian, NFFS, 4858 Moorpark Ave., San Jose, CA 95129.

• Thomas Herr's new rubber-powered kit model, dubbed the Scout, has a classic appearance, rather like a prewar "commercial cabin," and yet it incorporates such modern innovations as laser-cut sheet balsa parts and computer-drawn plans. The laser-cut components are truly impressive, with clean stringer notches and no fuzzy or crunched edges. The wing ribs have lightening holes which are octagonal, rather than round. Included in the kit are contest-quality balsa, two colors of tissue, molded plastic propeller and wheels, clear plastic for the windows, music wire, rubber, computer-drawn plans, and an illustrated instruction manual. See the Herr Engineering ad elsewhere in this issue for price and ordering information. Also available is a catalog of building materials, supplies and accessories, for $2, sent to Herr Engineering Co., 5648 Kingman Ave., Portage, IN 46368.

MECHANICAL BIRD POSTAL PROPOSITION

Model ornithopter enthusiasts have a fine opportunity to demonstrate their ideas in a contest organized by Nathan Chronister. The object is to encourage development of more realistic and efficient wing-flapping mechanisms. Two categories are presented: one for actual flying prototypes, and the other for untested concepts.

The event is open to anyone interested, no entry fee is required, and the deadline is March of 1995. For official rules, send a stamped, pre-addressed return envelope (or International Reply Coupons outside the U.S.) to Nathan Chronister, 3140 Route 209, #2A, Kingston, NY 12401.

SIGN-OFF

Our thanks to Herbert K. Weiss for this closing thought: "What a youth builds in his workshop is not as important as what a workshop builds in the youth." ***MB***

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HLDS002 **Skimmer Electric Sailplane**
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70" span, balsa kit is easy to build, durable. Skimmer climbs to "speck" height two or three times on a charge using cheapest Graupner Direct Drive System (order GR1162).

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GR455410 **Graupner "Up and Go" without motor** **$199.00**
GR4554 **"Up and Go" with ULTRA 1600-5 motor** **$424.00**
Fully assembled and ready for installation into 3 to 4 meter sailplanes. Incredible device centers prop for retracting. 10-1/2-6 prop is included and installed.

HLBW002 **PS Flyer 99"** **$79.00**
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CHARGER *continued from page 31*

tected. Connections are made by soldering directly to the leads of the device. Same goes for the 2N4401 transistor.

Testing the unit is very simple, and if you've wired it correctly, the unit can self-test itself by means of its own built-in milliammeter, the LED and your stopwatch. Double-check the input polarity and make sure the semiconductors are plugged in properly. Put the mode switch in the manual position and turn on the master switch. Select 50 milliamps and short out the output leads; the meter should read 50 milliamps. If so, you're on your way to success. You can now run through the various current positions while observing the meter. This completes the testing of the charger portion of the circuit.

To test the timer portion, keep the output leads shorted and reading some current, then select the 5 minute position on the timer switch. Flip the mode switch to the timer position and start your watch. The current should read the same as before and the LED should turn on, indicating that the relay is now energized. Remain very silent, turn off your radio or TV and as the 5 minute mark approaches, you should hear a distinct click, meaning that the relay has opened. If all is well, the LED has turned off and the current on the meter has dropped to zero. Eureka! All that remains is to patiently run through the other time positions and verify the duration of each.

If your components are out of tolerance, the value of the current or the specific charge time may differ somewhat from those given here, but that's certainly not a tragedy. The power rating (in watts) for R9, R10 and R11 are intentionally exaggerated to ensure that they do not have much temperature rise; this will ensure that the constant current feature of the charger is preserved.

Even though I started by saying this unit is designed for charging your flight packs, it can also charge any NiCd battery of seven cells or less; for instance, it can charge your single-cell Ni-starter or it can charge a six-cell 450-mAH pack, although the latter will take about an hour.

I hope you have fun building and using this charger. I'll be happy to answer any questions or try to help you out of any problems if you write to me: Jose M. Tellez, P.O. Box 733, Laguna Beach, CA 92652. I also would like to hear if you are successful!

SUPPLIERS

Digi-Key Corp., 701 Brooks Ave. S., P.O. Box 677, Thief River Falls, MN 56701-0677; (800) 344-4539.

D.C. Electronics, P.O. Box 3203, Scottsdale, AZ 85271-3203; (800) 467-7736

Radio Shack (your local branch). ***MB***

LOUIS GARAMI'S STRATO STREAK

AN .010 REPLICA

Interest in high-performance .010 free flight continues to grow. This replica of A 1941 favorite can easily hold its own against contemporary designs.

BY DICK JOHNSON

In the December 1941 issue of *Model Airplane News*, Louis Garami introduced his Atom .09 powered Strato Streak. The Atom was, of course, a spark ignition engine, so a coil, condenser and batteries were part of the payload. Flying weight was in the vicinity of 12-1/2 ounces.

Now, over half a century later, we present a tiny clone with a Cox .010 screaming away up front, hauling a ship that at just 1-3/4 ounces weighs less than the pair of pencell batteries the Atom needed!

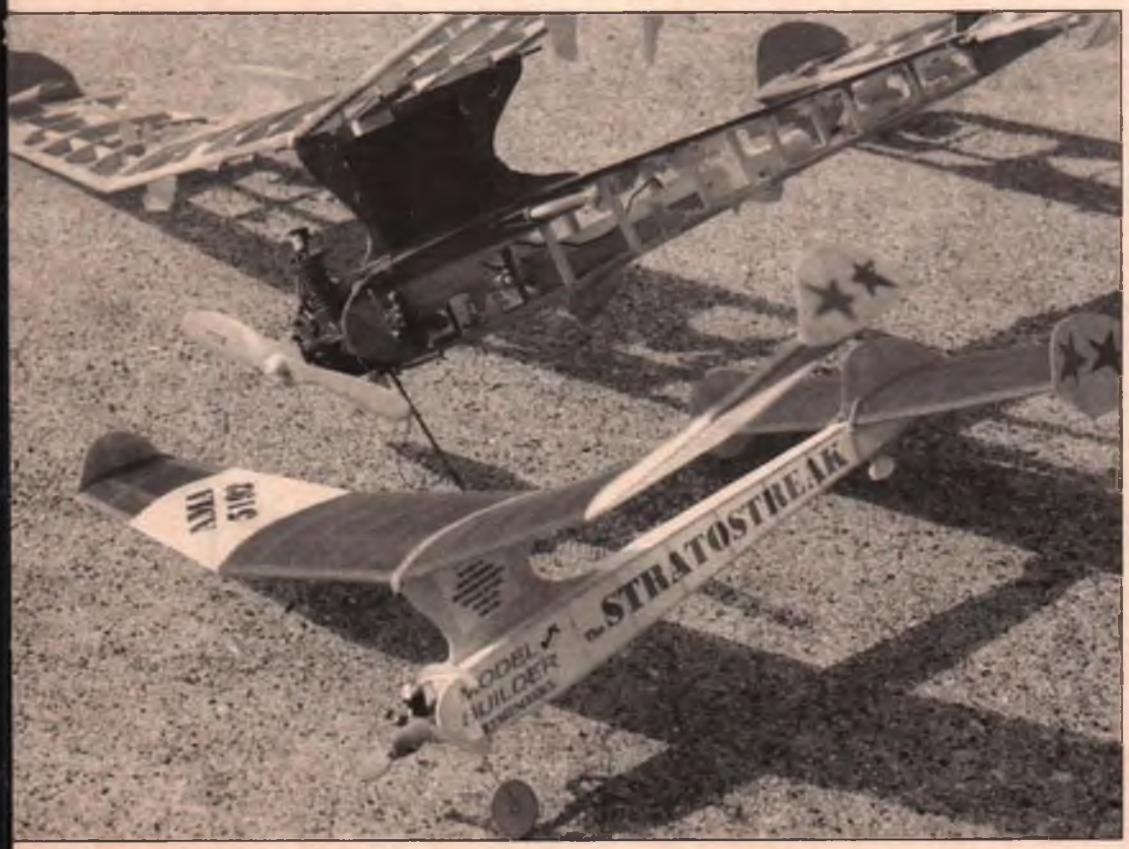
Shortly after WWII, the gent who designed the Atom, Ray Arden, gave us the much more powerful Arden .09, also spark ignition. Then, for an encore, he gave us the glow plug, and spark ignition model engines all but disappeared. It was about 1948, while a student at the University of Kansas, that one of our Jayhawk Sundusters model club members decided to replace the Atom in his Strato Streak with the hot Arden and the Strato Streak became a fantastic performer.

Among the happier experiences of the times was an association with the grand old man, C.O. Wright of nearby Topeka, Kansas. Mr. Wright was at one time AMA president and we younger modelers looked to him for guidance. Well, we did and we didn't. Three of us—Jack Jella, Stinson Smith and I—showed up at a 1948 contest in Independence, Missouri with our pristine Arden powered Strato Streaks. C.O. lectured us on the fact that a high center of lateral area (all of the vertical surfaces Mr. Garami elected to add wherever he found a place) was bad news, and so the Strato Streak was a very poor design. Trouble was, the Missouri thermals had not attended the class on excess C.L.A., and we placed 1st, 2nd and 3rd in Class A that day. Smart aleck youngsters that we were, we (respectfully) kept the incident alive at any subsequent discussion on free flight design.

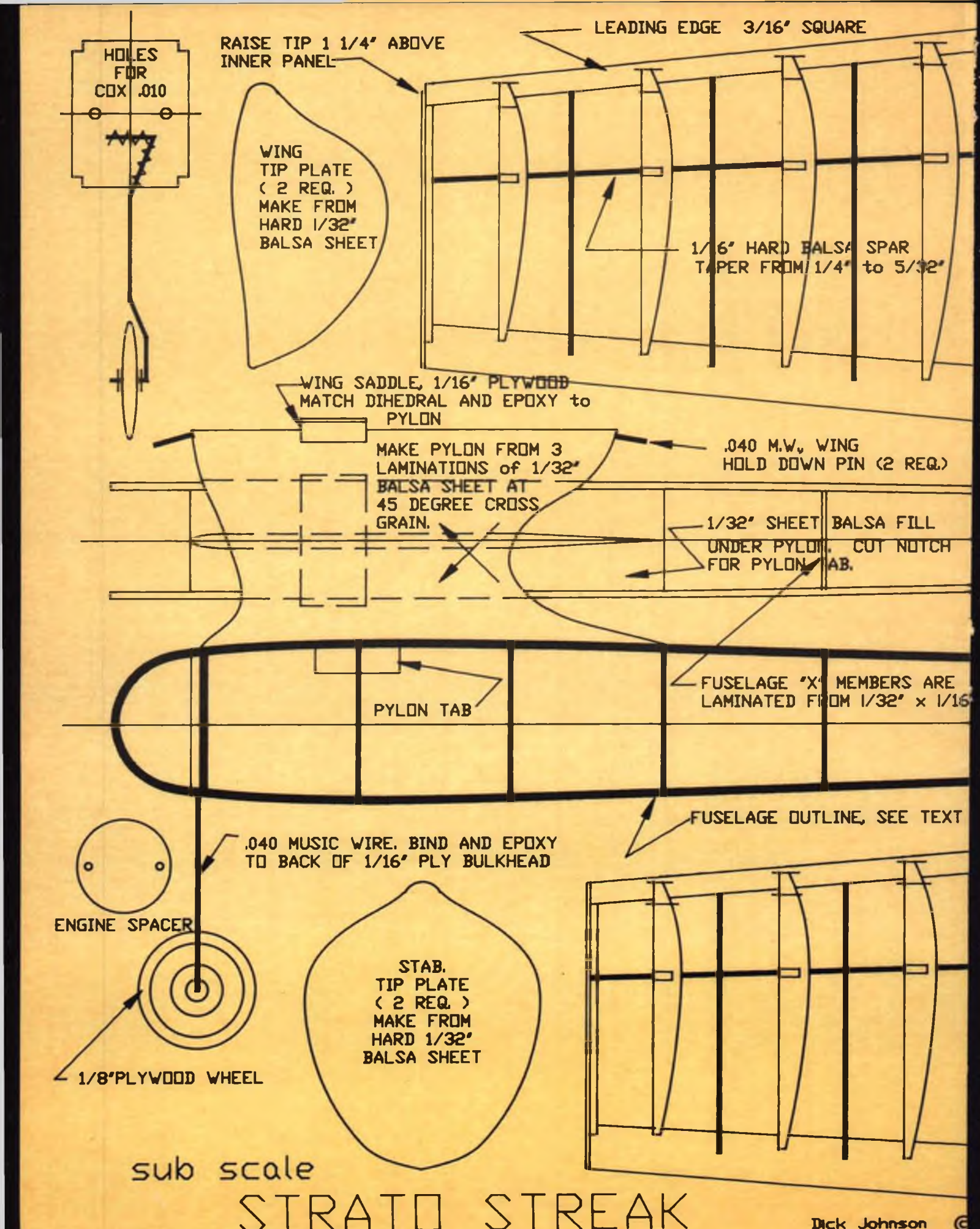
Today, as part of the Old Timer movement, the full-size Strato Streak with an ignition Arden continues to hold its own in competition. The design has become even more successful as an .020 replica. It remains to be seen whether a third generation can prove itself with an .010.

If you have ever built a stick-and-tissue model airplane, the simplicity of design of the Streak should charm you into a new free flight experience. For the fuselage longerons, we elected to use the laminated stick technique so popular with Peanut wingtips, however, 3/32 square and curved balsa sheet front and back should be fine if the laminations don't appeal to you.

A template is the starting place for laminated construction. Spray a piece of 1/16-inch thick illustration board with contact cement and attach the plan. With a knife and #11 blade, cut to the inside of the black fuselage outline, yielding a template. Rub the outside with a wax candle or piece of paraffin so that ce-



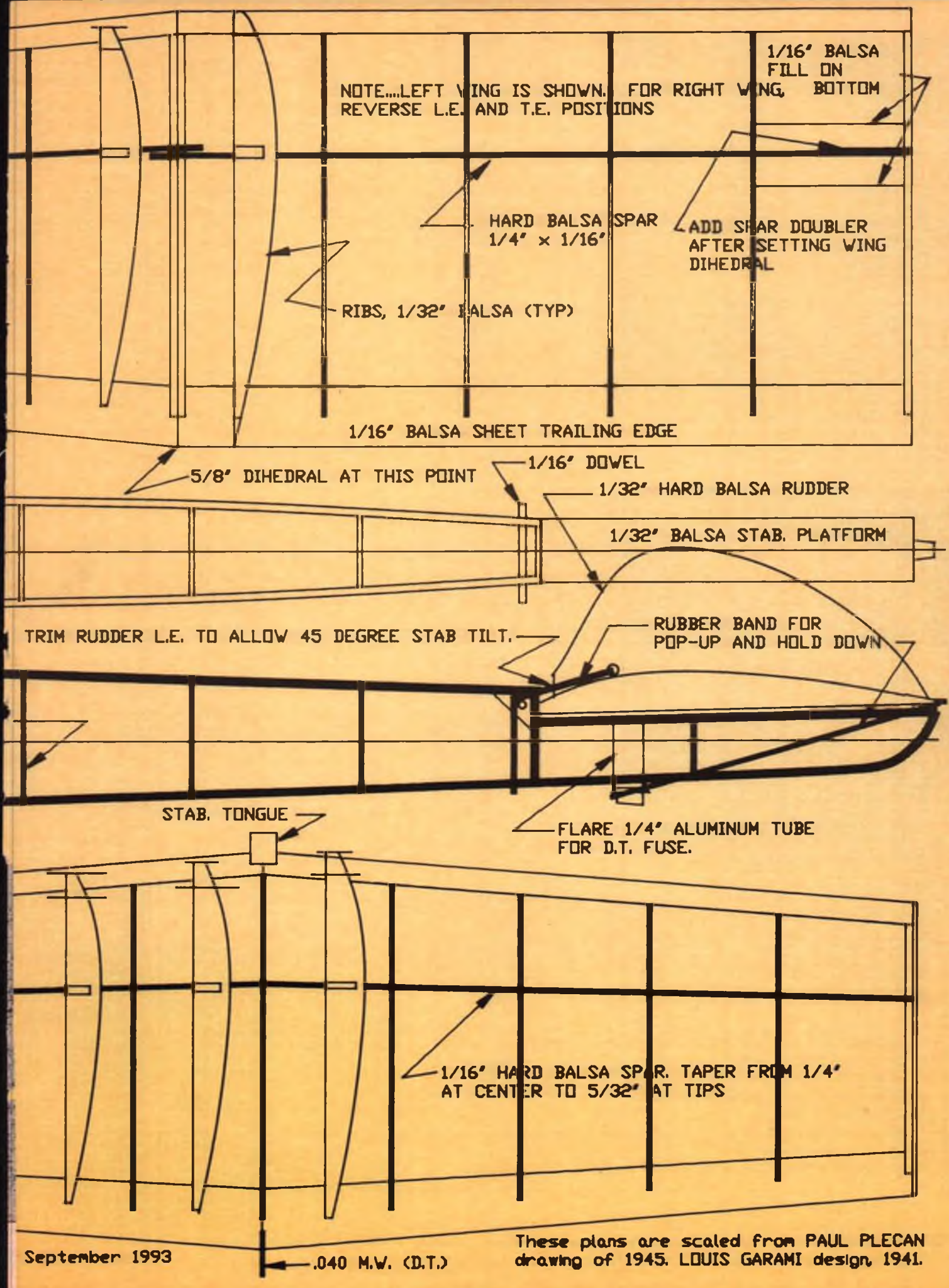
Birds of a feather. The author's .010 screamer is pictured with the full-size Atom .09 powered Strato Streak built by his son Guy in 1975 and which is now badly in need of a re-covering job. Graphics on the .010 ship were photocopied onto the material prior to covering, makes for a neat overall effect.



sub scale

STRATO STREAK

Dick Johnson ©



September 1993

These plans are scaled from PAUL PLECAN drawing of 1945. LOUIS GARAMI design, 1941.

Instead of the commonly used eyedropper tank, Dick uses a length of surgical fuel tubing wrapped around the nose; a mark on the tube (about 3 inches from the needle valve) indicates when there's 10 seconds of fuel left.

Stabilizer DT band simply loops around the bottom-mounted fuse. The author learned the hard way to make sure the band is around the fuse and not around the tube!

ment won't stick when the laminations are applied. Make strips from 1/32 sheet, about 1/16-inch wide; about 20 will be required. Soak the sticks for several hours in a window cleaning liquid rich with ammonia so they will take the curves easily. Brush thinned white glue on the sticks, joining three pieces together, wipe away the excess, and work the trio around the template. Scotch tape and rubber bands hold things till the outline frames dry. Make two.

When both frames are finished, put the template back in its original position in the plan cutout. A few pins placed in the resulting slit will serve to locate the frame over the plan and the rest of the pieces can be cut and glued in place. When the frames are complete, lightly sand both sides.

The fuselage sides can now be joined, first at the back, then at the front using the 1/8-inch plywood firewall with landing gear in place. Note that 1/32 balsa sheet is used on the top only to strengthen the pylon/fuselage junction. Wait until the fuselage is covered and the DT snuffer tube is installed before cementing the stabilizer platform in place.

The wing and horizontal tail construction is rather typical, the only tedious part being the number of ribs required. Rib templates cut from the illustration board backing makes that task go pretty fast. The tongue at the stab L.E. serves to align the tail during its pop-up action and should be a snug fit into the fuselage; 1/16 plywood or hard balsa with the grain running fore and aft works well.

As far as covering is concerned, we personally prefer good old Japanese tissue and fuelproof dope. There are also several light heat-shrink covering materials available, so don't shy away from them if they seem attractive. Keep in mind that the original Strato Streak was designed for a spark ignition engine and all of its associated items (coil, batteries, etc.), so the nose is short and the tail is long for balance purposes. Excess weight aft on this .010 clone could make for tailheaviness. We used an engine spacer made of 1/4-inch plywood, moving the engine forward to help locate the CG about 2-1/2 inches aft of the wing leading edge.

In the .010 class, the engine run is limited to 10 seconds, and no mechanical fuel shutoff device may be used. We removed the integral tank and replaced it with the tankless backplate (Cox P/N 1327). A piece of surgical tubing having an inside diameter of about 1/16-inch and a length of 6 inches holds enough fuel to get the engine started and peaked. Experiment with it and make a mark on the fuel line (on ours it's a bit less than 3 inches from the carburetor connection) so you'll know when to launch.

The pop-up tail is quite effective for escaping thermals. A 45 degree angle seems to work well, although I don't believe the angle is critical. A rubber band making about a 1-3/8 inch relaxed circle seems about right to raise the tail when the fuse burns through the hold-down band. An S-hook made from a pin joins the rubber band under the fuselage. When the tail is down and the system is "cocked," make certain that the band is around the fuse and not around the snuffer tube. Not too long ago we watched through hints of tears as our "Spirit of '48" Strato Streak with a precious Arden .09 remained in the clutches of a Texas monster thermal, remembering that the band was around the aluminum tube, not the fuse. S/N 2112, please call home.

If flight trimming these little buzz saws is new to you, check the September 1993 issue of *Model Builder* where P.A. Collins gives some good advice on trimming his .010 Microduster. Also, in the August '93 Free Flight column, Bob Stalick supplies some interesting background about this great new class of old time free flight.

Model Builder remembers The Strato Streak and you too can enjoy a model design that Louis Garami introduced over half a century ago, one that easily holds its own in modern times. ***MB***

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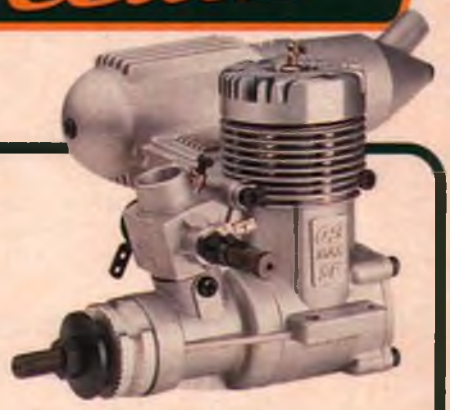

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Setting Up Miniature Aircraft's X-Cell 60

BY JAMES WANG

Unquestionably the most popular .60-size heli on the market, the X-Cell 60 has established an enviable reputation among beginners and experts alike. Here's how our resident heli expert recommends setting it up for different levels of performance.

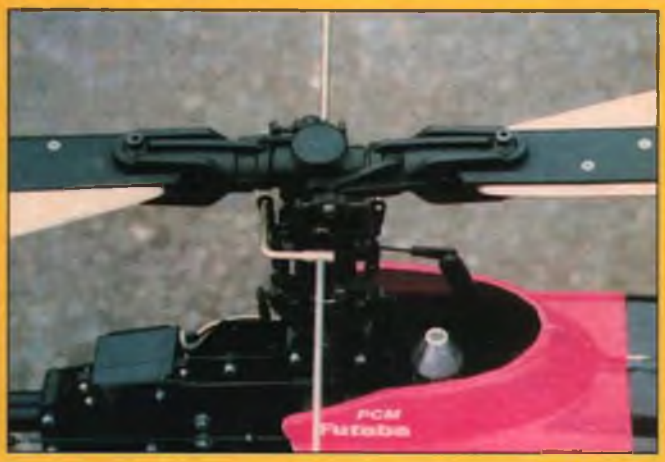
Of all the .60-size helicopters on the market, I think Miniature Aircraft's standard X-Cell 60 provides the best value for the money. It's docile enough for the novice, smooth enough for FAI competition, and agile enough for wild 3-D hotdogging. This versatility is quite unusual. I have both an X-Cell Custom and a standard X-Cell 60; I use my standard X-Cell 60 with an Airtronics Infinity 660 radio, O.S. .61 SFN engine and Magna U-shaped tuned pipe for everyday fun flying. As far as I'm concerned, the above combination gives the best performance for the money of any .60-size helicopter.

Our columnist's flying buddy, Xeno Xenophonos, performs an effortless nose-in hover with his X-Cell 60. It's one of the best .60-size models for all-out hotdogging and aerobatics, yet is very stable and can be used as a beginner's first helicopter.

For beginners who are considering building an X-Cell 60, I highly recommend buying a modern programmable helicopter radio. It can carry you from learning to advanced aerobatics. The less expensive nonprogrammable five- and six-channel systems won't be adequate for fancy aerobatics after you've become a proficient flier. In the July 1992 *Model Builder*, I discussed and reviewed the Futaba 7UHP and 7UHF; the Airtronics Infinity 660 was reviewed in February 1994, and the new JR XF622 was reviewed in September 1994. Of these, I feel the Infinity 660 has the best factory presets. The default program settings are nearly perfect for the X-Cell 60. You can almost go out and fly an X-Cell without tweaking the default settings.

In general, I use the normal throttle mode for hover and vertical climb; idle-up 1 for loops, rolls and all smooth forward flight maneuvers; and idle-up 2 for 3-D aerobatics. Both idle-ups employ U-shaped throttle and U-shaped tail rotor mixing curves (Figures 1 and 2). When setting up the throttle and pitch curves, the objective is that when the model is hovering at mid-stick in the normal mode, flicking on idle-up 1 or 2 will cause an increase in rotor speed by 100 and 200 rpm respectively without causing a sudden jump or drop in altitude, because as the throttle is increased, the collective pitch is reduced simultaneously. The U-shaped throttle curve allows the model to do switchless inverted flight in idle-up 2 and perform loops and rolls in idle-up 1.

The X-Cell 60 kit is quite sophisticated. First-timers would be well advised to get some help throughout the assembly, setup and flight trimming stages.



The X-Cell 60 uses a floating axle Delta-3 rotor head; it stabilizes blade motion by automatically reducing the blade pitch angle when a gust causes the blade to flap up.

Table 2 gives suggested collective pitch and throttle settings for the X-Cell 60. Use a good pitch gauge to measure the blade angle—Miniature Aircraft, Schluter and Kalt pitch gauges work the best. Always set the top and bottom end pitches for idle-up 2 first, because it has the broadest pitch range. Make sure there is no binding at full positive and full negative pitch in idle-up 2. Now adjust the radio's pitch curve to give 4 degrees at half throttle stick. The suggested carburetor openings are given in Figure 1 (100 percent represents full open, or full throttle; 0 percent means the carb is closed completely). At low throttle stick and full throttle trim, the carb should be about 10 percent open, which gives a good idle. When the throttle trim is moved all the way down, the carburetor closes all the way to shut off the engine. Beginners should use no more than -1 degree of negative pitch, because when practicing

continued on page 74

TABLE 1—SUGGESTED FUTABA 9ZHP PROGRAMMABLE MIXES FOR THE X-CELL 60

	mas-slv	inh	R/U	L/D	sw	trm		ots
MX1	AU2-ELV	OFF	+2%	+2%	4	OFF	+	0%
MX2	THR-AIL	OFF	+7%	+2%	4	OFF	+	0%
MX3	THR-RUD	OFF	+24%	-4%	4	OFF	+	24%
MX4	THR-ELV	OFF	+3%	+1%	4	OFF	+	0%
MX5	AU2-GEA	OFF	+100%	-100%	4	OFF	+	0%

TABLE 2—THROTTLE OPENINGS AND BLADE PITCH FOR THE X-CELL 60

For Beginners:

	Collective Pitch			Throttle Opening		
	Low	Middle	High	Low	Middle	High
Normal	-1	4.5	9.25	0%	46%	100%
Idle-up 1		Don't use			Don't use	
Idle-up 2		Don't use			Don't use	
Throttle Hold		Don't use			Don't use	

For Intermediates and Competition:

	Collective Pitch			Throttle Opening		
	Low	Middle	High	Low	Middle	High
Normal	-3	4.5	9.25	0%	43%	100%
Idle-up 1	-3	4.25	9	30%	46%	100%
Idle-up 2	-6	4	9	70%	48%	100%
Throttle Hold	-6	4.5	10.5			

For 3-D Aerobatics:

	Collective Pitch			Throttle Opening		
	Low	Middle	High	Low	Middle	High
Normal	-4	4.5	9.25	10%	43%	100%
Idle-up 1	-5	4.25	9	60%	46%	100%
Idle-up 2	-9	4	9	100%	48%	100%
Throttle Hold	-6	4.4	10.5			

Figure 1 — X-Cell 60 Throttle Curves

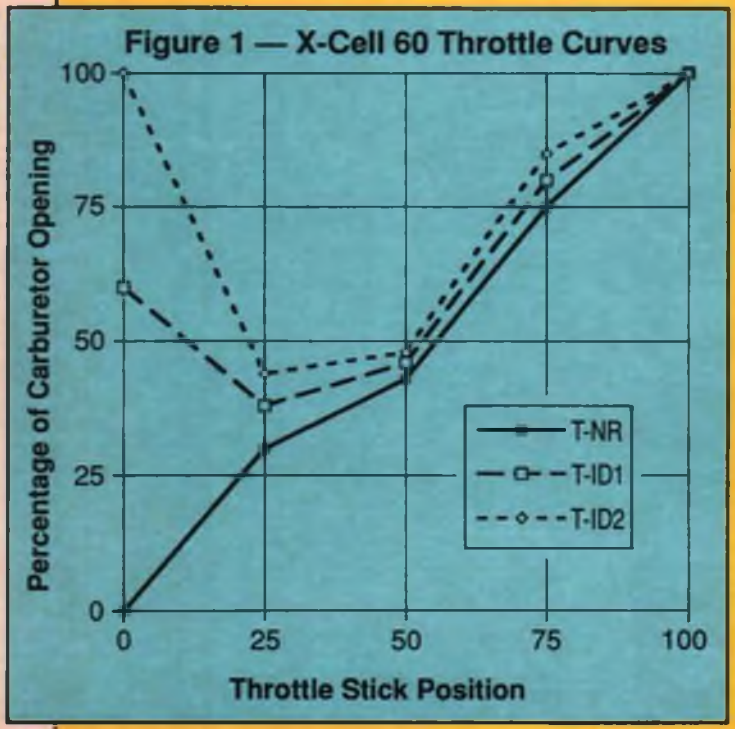
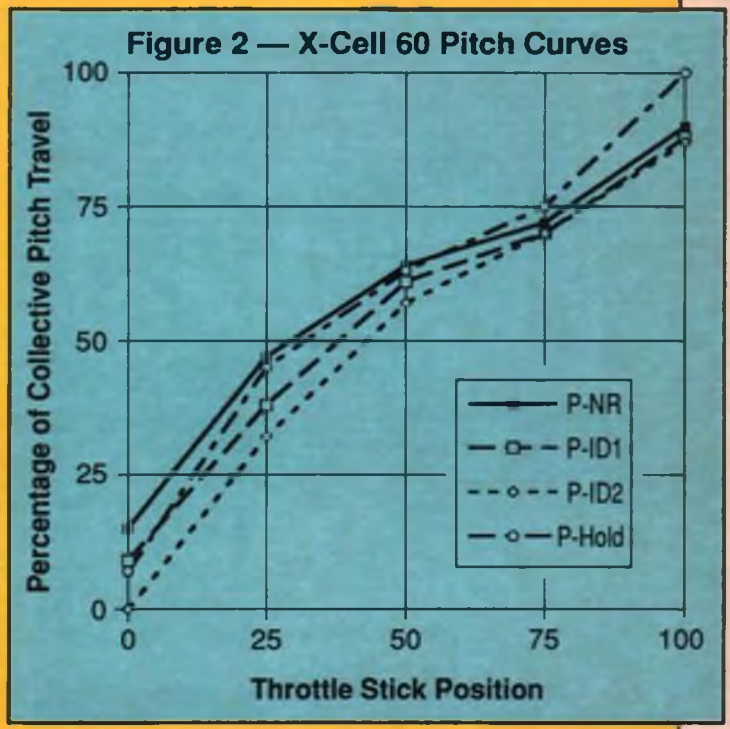


Figure 2 — X-Cell 60 Pitch Curves



Ray Olsen and David Diesen of Competition Composites show off their new 113-inch Blackhawk F3B and multi-task competition ship. Features molded carbon fiber wings and tail and a proprietary Selig airfoil system, all popped out of a machined aluminum mold.

George Hunter of Oakland Model Academy (510-839-0436) with his company's Ultra GP. This extremely durable pivot-wing slope rocket spans 55 inches and runs a modified SD8000/SD7003 airfoil. As George demonstrated, it rolls literally in a blink of the eye, even while flying slowly on landing approach!

Line-up of scale ships, waiting their turn for the thermal portion of the scale glider competition. Some real beauties here!

Straining to hold his 22 foot, 1/4-scale Schleicher ASH-25 is Tony Elliot of Boise, Idaho. Model was built from scratch using a Gewalt fuselage from Germany; wing uses a Ritz 3 airfoil at the root, transitioning to a Ritz 2 at the tip. With its wings flexed up in flight it captured all the grace and elegance of the full-size sailplane.

THE 1994 WORLD SOARING JAMBOREE

Ten full days of just about every RC slope and thermal soaring event imaginable, this year's WSJ was the first of what we hope will become an annual affair.

The Tri-Cities area in southeastern Washington has long been a mecca for scale soaring enthusiasts, with a yearly fun-fly on two fabulous slopes. This year, event coordinator Wil Byers rounded up the support of numerous clubs and sponsors to put on a 10-day festival of soaring fun and competition. The World Soaring Jamboree, held May 28-June 6, was truly an event not to be missed!

With Eagle Butte and Kiona Butte for slope and a 450-acre sod farm for thermal, the WSJ had world-class sites for every type of RC soaring. The Tri-

BY GREGORY VASGERDSIAN

Undisputed show-stopper of the meet was the monstrous 1/4-scale, 21-1/2 foot span OBS sailplane built by Canada's Eric Eiche. The full-size aircraft was built in 1932 and was used for meteorological research. Eric's model made its maiden flight at the WSJ.

Canopy detail of Eric Eiche's OBS reveals flawless workmanship. Note the navigator/researcher facing rearward in the aft cabin. Map and books on his worktable could actually be read—with a magnifying glass!

Another of Eric Eiche's scratch-built jewels was this 1/4-scale Fafnir. With its beautiful lines and stunning craftsmanship it was a true flying museum piece.

Steve Yurchevich of Calgary, Canada is dwarfed by his 13-foot, 1750 square inch cross-country ship. Model features an SD3021 airfoil, 10.5 ounce wing loading. The cross-country task was a 22-mile out-and-return, but a lack of lift made for pretty short flights.

That the unlimited thermal duration portion of the WSJ was plagued with high winds is evident in this shot of Harold Ochs launching his Jouster. Site is a perfectly flat 450-acre sod farm in Kennewick.

Close-up of the root section of Eiche's Fafnir fuselage. Root airfoil is a Göttingen 652 transitioning to a Go-535, and then to a Clark Y at the tip, just like the full-scale ship. Note the beautifully fitted individual wood panels on the fuselage.

Spoilers deployed, England's Robin Sleight is about to nail the spot. Model looks like it could be an F3J ship.

Fred China's 4-meter ASK-13 takes to the air for its judged scale thermal flight. Model was scratch built from Cliff Charlesworth plans, and although Fred's model came in 7 pounds heavier than specified, it thermalled wonderfully.

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SIZE	USE	PRICE
5.5 X 2	1	1.59
5.7 X 3	1	1.59
6 x 2	1	1.59
6.3 X 4	2	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	4	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
8.5 X 5	4	3.95
8.5 X 5.5	4	3.95
8.5 X 6.5	5	3.95
8.5 X 7.0	5	3.95

SIZE	USE	PRICE
8.5 X 7.5	5	3.95
8.75 X 7.0	5	3.95
8.75 X 7.5	5	3.95
8.75 X 8.0	5	3.95
8.75 X 8.5	5	3.95
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
9.5 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

SIZE	USE	PRICE
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

SIZE	USE	PRICE
12.5 X 12.5	7	7.95
12.5 X 13	7	7.95
13 X 6		4.25
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 12		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
14 X 6		12.95
14 X 8		12.95
14 X 10		12.95
14 X 11		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

SIZE	USE	PRICE
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	10	12.95
15.5 X 13N	10	12.95
16 X 8		12.95
16 X 10		12.95
16 X 12		12.95
16 X 13N	10	12.95
16 X 14		12.95
16 X 16		12.95
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22 X 10	13	31.00
22 X 12	13	31.00
22 X 14		31.00
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20 X 12	13	37.00
20 X 14		37.00
21 X 10		37.00
21 X 12		37.00
22 X 10		45.00
22 X 12		45.00
22 X 14		45.00
22 X 16		45.00

SIZE	USE	PRICE
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24 X 12		55.00
24 X 14		55.00
24 X 16		55.00
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Cities (Pasco, Kennewick and Richland) are located on the beautiful Columbia River in an area that claims to have 300 days of sunshine a year. The event was heavily sponsored by the Richland Chamber of Commerce, *R/C Soaring Digest* magazine, JR Remote Control and Slegers International, as well as a host of other sponsors in the hobby industry. The local newspaper and news stations featured the events throughout the 10 days and were often seen interviewing modelers at the different sites.

The WSJ started with novice thermal, slope scale, and unlimited thermal. In the novice event, fliers received instruction on using winches, thermal hunting and landing approach techniques. The format was well received and brought home the point of having fun while expanding soaring skills and knowledge.

At Eagle Butte, the slope scale fun-fly kicked off with a light rain squall, which cleared out by noon for great westerly winds. With 70 entrants, a wide variety of models and plenty of wind, the scale fun-fly came off a big success for pilots and spectators alike.

At the sod farm in Kennewick the two-day unlimited thermal event was plagued with less-than-ideal conditions. Equipment problems were solved quickly enough, but high winds made flying a challenge. On the second day the winds were nearing 30 mph. Launching in high winds is always precarious, and a number of models were destroyed on launch.

High winds were not a problem at the slope fun-fly on Eagle Butte—in fact, conditions were truly phenomenal. Many pilots quit when the wind reached 40 mph, but when the wind peaked at 70 in the late afternoon there were as many as five slope rockets in the air at once, carving *really* big sky maneuvers. Call it nuts or just white-knuckle flying, these guys were really having a blast! The air was surprisingly smooth and stable, and with the large landing area, landings did not pose much of a problem.

At the Sunday night banquet, after a day of windburn on the slope, modelers had a chance to chat with guest speaker Professor Dr. Michael Selig. Dr. Selig gave an overview of his past work using slides, video and viewgraphs. He also released the coordinates for his new S7012 airfoil, which could be a hot one for slope racing. An improved S7003, it has a little more camber and should have better speed than both the S7003 and RG15; it should also be better than both in turns.

Monday through Thursday saw novice slope racing, unlimited slope racing and 60-inch slope racing. Novice and 60-inch were run at Kiona Butte, unlimited at Eagle Butte. All were run by the Seattle Area Soaring Society. The two-man, three-deep format worked well and kept the chance of collisions down while permitting lots of racing.

The 2-meter thermal competition ran on Monday at the sod farm with absolutely beautiful weather. The format was a 3-5-7

continued on page 81

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103	5/32	35
104	3/16	40
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106	1/4	50
107	9/32	55

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125	1/16	35
126	3/32	40
127	1/8	40
128	5/32	50
129	3/16	55
130	7/32	60
131	1/4	70
132	9/32	80
133	5/16	90
134	11/32	95
135	3/8	1.10
136	13/32	1.25
137	7/16	1.35
138	15/32	1.40
139	1/2	1.55
140	17/32	1.65
141	9/16	1.75
142	19/32	1.90
143	5/8	2.00
144	21/32	2.25

COPPER TUBE (12")

117	1/16	35
118	3/32	40
119	5/32	50
120	1/8	45

SOFT BRASS FUEL TUBING (12")

121	1/8	50

RECTANGULAR BRASS TUBE (12")

STOCK NO.	SIZE	PRICE EACH
262	3/32 x 3/16	1.30
264	1/8 x 1/4	1.40
266	5/32 x 5/16	1.80
268	3/16 x 3/8	1.85

BRASS STRIPS (12")

230	016 x 1/4	25
231	016 x 1/2	35
232	016 x 1	50
233	016 x 3/4	45
234	016 x 2	95
235	025 x 1/4	30
236	025 x 1/2	50
237	025 x 1	90
238	025 x 3/4	65
239	025 x 2	1.70
240	032 x 1/4	35
241	032 x 1/2	55
242	032 x 1	95
243	032 x 3/4	75
244	032 x 2	1.90
245	064 x 1/4	70
246	064 x 1/2	1.15
247	064 x 3/4	1.40
248	064 x 1	1.90
249	064 x 2	3.40

SQUARE BRASS TUBE (12")

149	1/16 Square	65
150	3/32 Square	80
151	1/8 Square	90
152	5/32 Square	1.00
153	3/16 Square	1.10
154	7/32 Square	1.20
155	1/4 Square	1.40

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122	Small	90

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STOCK NO.	SIZE	PRICE EACH
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251	010 Brass	1.40
252	015 Brass	1.90
253	032 Brass	3.50
254	008 Tin	90
255	016 Alum	1.00
256	032 Alum	1.40
257	064 Alum	2.20
258	Assr. Brass	2.75
259	025 Copper	3.50

BRASS ANGLE (12")

171	1/8 x 1/8	55
172	5/32 x 5/32	65
173	3/16 x 3/16	55
174	7/32 x 7/32	60
175	1/4 x 1/4	65

BRASS CHANNEL (12")

181	1/8	70
182	5/32	80
183	3/16	65
184	7/32	70
185	1/4	75

SOLID BRASS ROD (12")

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160	1/32	12
161	3/64	15
162	1/16	20
163	3/32	25
164	1/8	40
165	5/32	60
166	3/16	80
167	114	40
168	081	40
169	072	25

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TRAYS VITE

The author has always leaned toward the unusual, and his latest creation is no exception; although of conventional configuration, it's built almost entirely of foam hamburger trays! An extremely versatile design, it can be built FF or RC (one or two channels), with .020, .049 or electric power... take your pick!

BY ROY L. CLOUGH, JR.

Model airplanes really *are* great. Why? Because that mechanical bird flying around up there, that collection of sticks and stuff you put together, is your baby. Doesn't matter if a thousand like it have been built by a thousand other people. Each one reflects the unique personality of its builder, and this one is yours.

Sounds like deep-down fun, but you won't get there for nothing. You can lay out fairly important bucks for an ARF, or, for a bit less, buy a kit. Lastly, you can go from scratch.

Scratch? For a beginner? Isn't scratch building the toughest way of all? Not necessarily. In fact, scratch can be the *easiest* way to get into model building. Find a good set of simple plans and build your plane one stick at a time from raw materials. Go at your own pace. Cultivate a laid-back outlook and keep in mind Clough's Principle: "Nothing is worth getting if it isn't cheap enough and easy enough to leave you the resources to enjoy it."

TRAYS VITE exemplifies that principle. It's made from foam hamburger trays. You can't get started cheaper or easier. Most of the shaping needed is already hidden in the raw material. While it won't cost an arm and a leg to trash it if you run out of juice, stick with it and you'll get encouragingly spectacular results.

Deli trays are made of a closed foam to which practically nothing will stick, with one exception: UFO cyanoacrylate glue. I prefer the fairly thick variety. Most CA glues dissolve foam like hot coffee on sugar cubes, but UFO doesn't melt foam or produce eye-smarting fumes.

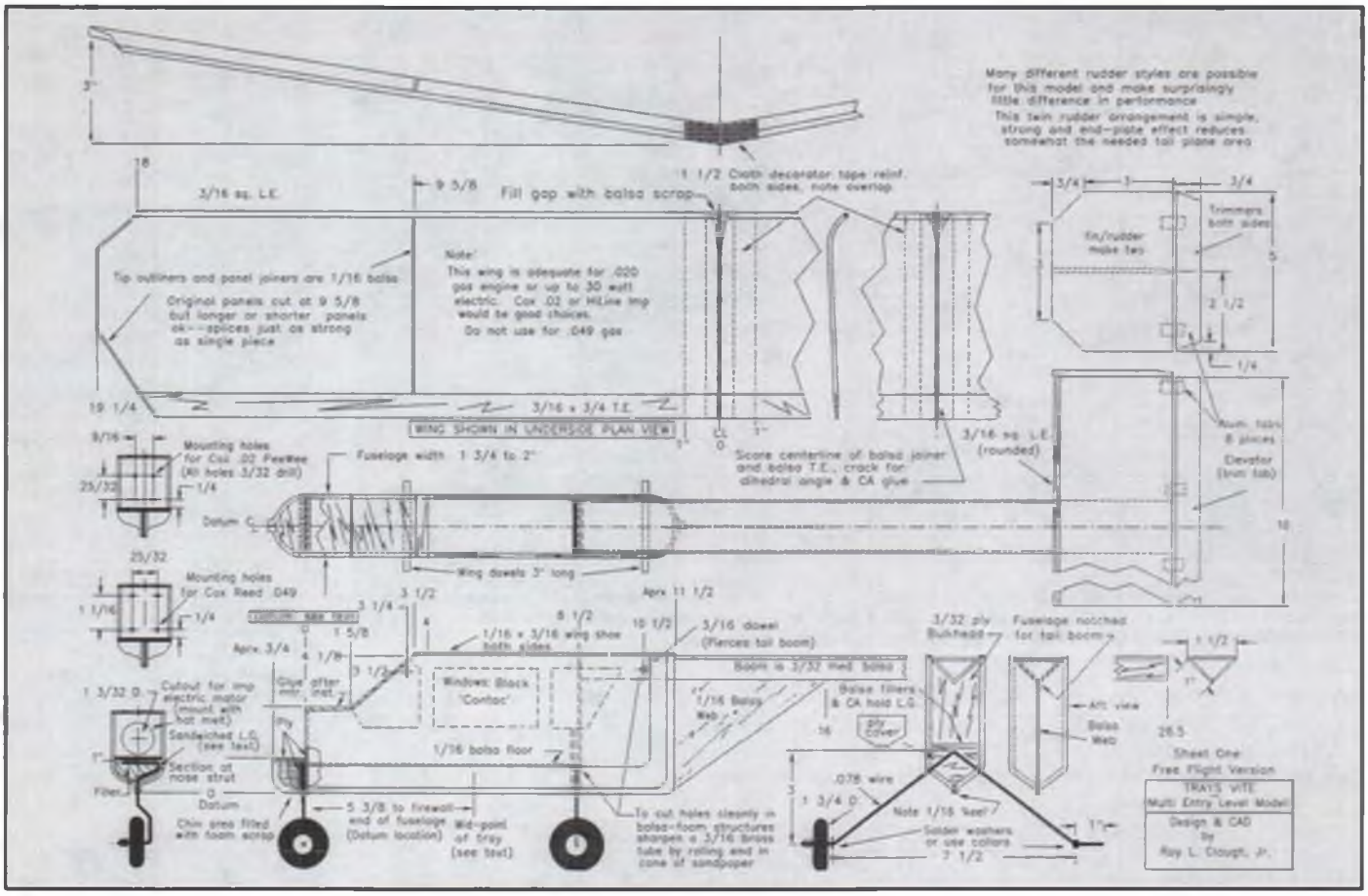
Foam deli trays come in many shapes and sizes. You want the smooth ones, not the waffle-grid type. Study the plans with attention to the cross-sections. The fuselage, for example, does not have to be exactly the cross-section shown on the plan, but shoot for similar dimensions and volume.

The wing takes advantage of the curved edges of the trays to form the airfoil. Don't worry about wringing out that last 10 percent of performance. Any shape that looks reasonably like a wing section will fly OK. What does matter is alignment, balance and angles of the wings,

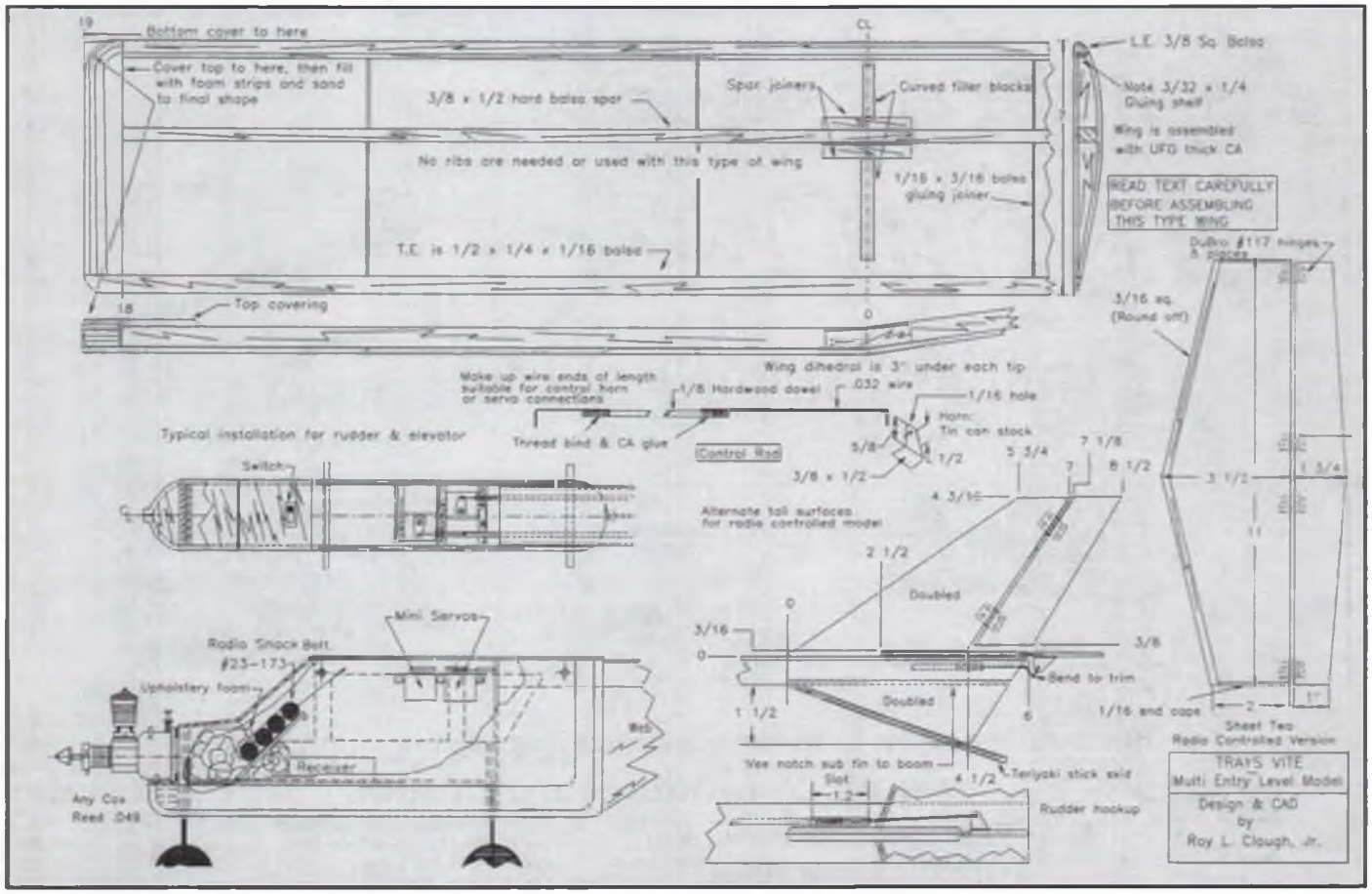
Once you get used to working with the foam material, experimenting with different configurations can be done quickly and at practically zero cost. Pictured at right is TRAYS VITE with what Roy calls his "virtual aileron" (polyhedral) wing for aerobatics. Or stretch the wingspan a bit, leave off the landing gear and make a powered glider. The possibilities are endless.

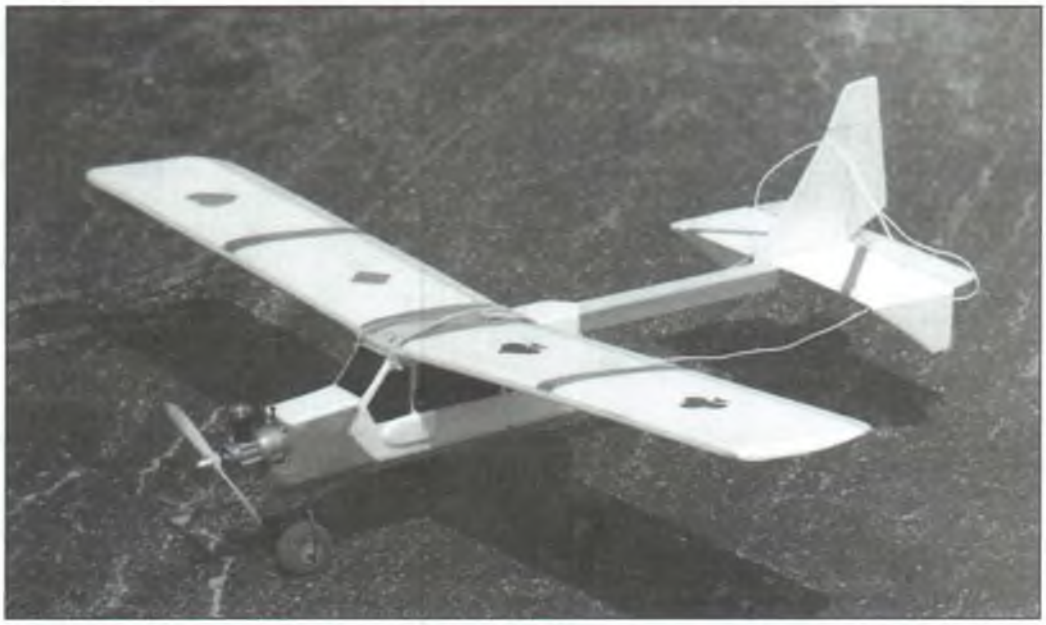
EDITOR'S NOTE:

The text that Roy supplied with this article is a fascinating but quite lengthy piece of work—7,200 words. What appears here is a much shorter version, carefully pared down to make it fit the available space and yet still detailing many of the different techniques used in the construction of this unique model. A copy of the complete full-length text will be included with the full-size plan set.



Note: Not shown here is a third sheet detailing the installation of the single-channel Cox FailSafe RC system in the .020 powered TRAYS VITE. All three sheets are included with Plan #11941.





Another variation on the theme, the "Snap Rolling Fool" version of TRAYS VITE with an oversize balanced rudder. This one plowed into a road shoulder when the wing broke at a partially dry wing joint, flew again two days later.

tail and rudder. Concentrate on these and TRAYS VITE will fly.

Wing, motor and wheel positions should come out about the same as shown on the plan. The original wing was glued up from four pieces; use fewer or more sections depending on the size of available trays. Be sure to use a balsa strip joiner between the panels. Balsa strip joiners are the Big Secret to the successful joining of foam sections. Just wetting the foam with CA and putting the edges together can keep the glue in liquid form almost as well as the bottle it came in. Inserting a strip of 1/32 balsa will result in a quick-setting, rock-stiff joint.

CONSTRUCTION

The FF or Single-Channel Model

Let's start with something that's almost impossible to screw up—the tail boom. Bevel the edges of two 1-inch wide pieces to get flats to hold some glue. Pin them to a 1-1/2 inch wide strip pinned flat by the ends, align them and tack the edges every 2 or 3 inches with a drop of UFO. When dry, stand it on end and run several drops of Elmer's white glue down all three inside corners; let it run full length to fill the seams.

Study the fuselage pod design before cutting anything. Opposite sides of the same tray may not be quite symmetrical; better to cut the opposing sides by matching two different trays. If your trays are shorter or longer than those used for the original model the difference will show up in a shorter or longer fuselage "chin," and the boom may exit the fuselage either side of the point shown on the plan. No sweat. The important thing is that the front end of the boom and the main landing gear bulkhead are 8-1/2 inches back from the firewall.

Cut out the sides and glue a balsa joining strip to the lower edge of one half-shell. Hold it flat against a wax paper covered surface until the CA sets. Now you have a straight seam

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against which to glue the other half.

Align and install the 3/32 plywood bulkhead, the tail boom and its sheet balsa reinforcing web. The rear landing gear wire is tacked in place with CA. Fill in around the wire with scraps of 3/32 balsa.

Install the firewall (with nose gear). Pack the chin area with scraps of foam. The balsa cabin floor rests on the inside corners of the tray sections between the main bulkhead and the firewall. The windshield and top of the fuselage behind the firewall are covered with 1/16 sheet balsa. Leave off the top cover until after the powerplant is installed.

The wing is easy. The curved edges of the trays are used to shape the airfoil. Cut the panels from as many trays as needed to fill out the span. Use balsa joiners between adjacent flat sections. Gaps between the curved leading edge joints are filled in with pieces of scrap after the wing is taken up and trimmed flush with a sharp razor blade.

After assembly, true up the front and rear edges of the wing with a straightedge and razor blade and glue on the balsa leading and trailing edges. Round off the leading edge. To add the dihedral, cut completely through the leading edge and the wing's curved surface at the center joint for about 1 inch. Score the rest of the wing center joiner fairly deeply on the bottom side but don't cut through. Score the balsa trailing edge lightly on both sides. Now crack the center section upward along the score and raise the free end of the wing 6 inches above the work surface. Put several drops of CA along the cracked center section and let it harden.

Cover the center section with 1-1/2 inch wide cloth decorator tape. This strengthens the joint and protects the foam surface from the rubber bands that hold it to the fuselage.

The tail surfaces are simple flat cutouts with rounded edges. Control tab hinges are strips of soft aluminum.

The FF version of TRAYS VITE has flown successfully with both the Cox Pee Wee .020 engine and the HiLine Imp electric motor. If you choose the latter, mounting the motor with two or three fat drops of hot melt glue will make it easy to adjust the thrustline—simply soften the glue gobs, tilt the motor and let it harden in the new position. For battery mounting, stick a length of sticky-back Velcro to the floor and a piece of its mating grabber to the battery pack. Now you can easily move the pack backward or forward to adjust the CG.

If you choose the Cox .020, make up a second 3/32 plywood firewall, CA glue it to the existing firewall and redrill the mounting holes. Seal the plywood with clear water-based latex varnish.

Balance the model so it hangs level when supported on fingertips one-third of the way back from the wing's leading edge. This is easy with the electric model, with its moveable battery pack. The gas engine version may require a dab of clay or sliding the wing slightly fore or aft. (My favorite

continued on page 68

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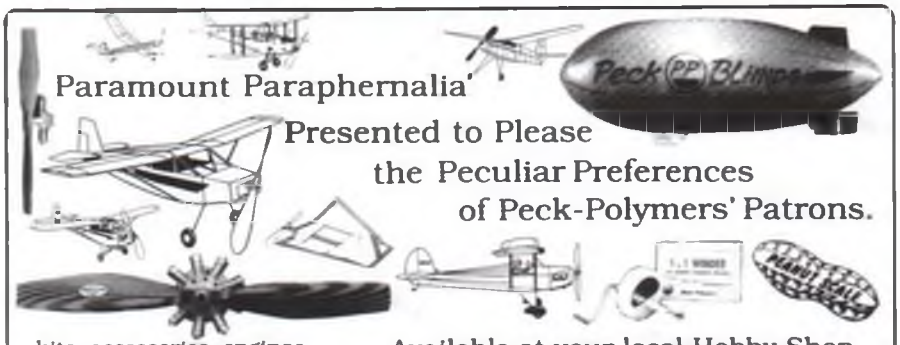

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PLUG SPARKS

BY JOHN POND

• SAM 21's All-Texaco Contest

• Paul Marichal's Hepcat Old Timer

• Aero .35 History

As SAM continues to expand, this columnist has noted a growing groundswell of interest in "fun" or sport events. Examples are the Brown Jr. event, Ohlsson .60 event and others devoted to the idea of flying models as they were originally flown in their era. In line with trying new ideas, SAM 21 decided to have a "fun" contest this year and announced the first All-Texaco Two-Day Annual.

The idea was that there would be nothing but Texaco type events; all but the 1/2A and electric events would be limited to 4cc of fuel per pound of model; and all flight times would be limited to 20 minutes except for the 15 minute 1/2A events. Now came the tricky part! For tiebreakers, the one with the shortest motor run would be declared the winner. Many of the contestants expressed doubt in being able to accurately judge the end of the motor run, as most models would be at 2,000 feet or better at the time, but it turned out that putting the model through a few simple maneuvers made it easy to check whether the engine was still running.

Photo No. 3. A rarely seen prototype version of the Modelcraft Pacific Ace. George Finato flew this Drone diesel powered model to 2nd place in the small-engine Fuel Allotment event at the SAM 21 contest.

The events flown were as follows:

1. Standard Texaco (SAM Rules).
2. 1/2A Texaco.
3. Brown Jr. Texaco.
4. Electric Texaco.
5. 1/2A Texaco Scale.
6. Fuel Allotment (.33 cu. in. and below).
7. Fuel Allotment (.35 cu. in. and above).

Notice should be made of the latter two events. These were very popular five or so years ago. In these events, any Old Timer model could be flown with any engine. This allowed those with Playboys, Zippers, etc. to join in on the fun. And fun it was!

Photo No. 1 shows what we mean: Tom Smith's 110 percent Anderson Pylon. Tom has been on a winning streak lately and the SAM 21 contest was no exception, as he placed 1st in standard Texaco. While mentioning winning streaks, Tom also won the raffle for an Airtronics RC system. When you're hot, you're hot!

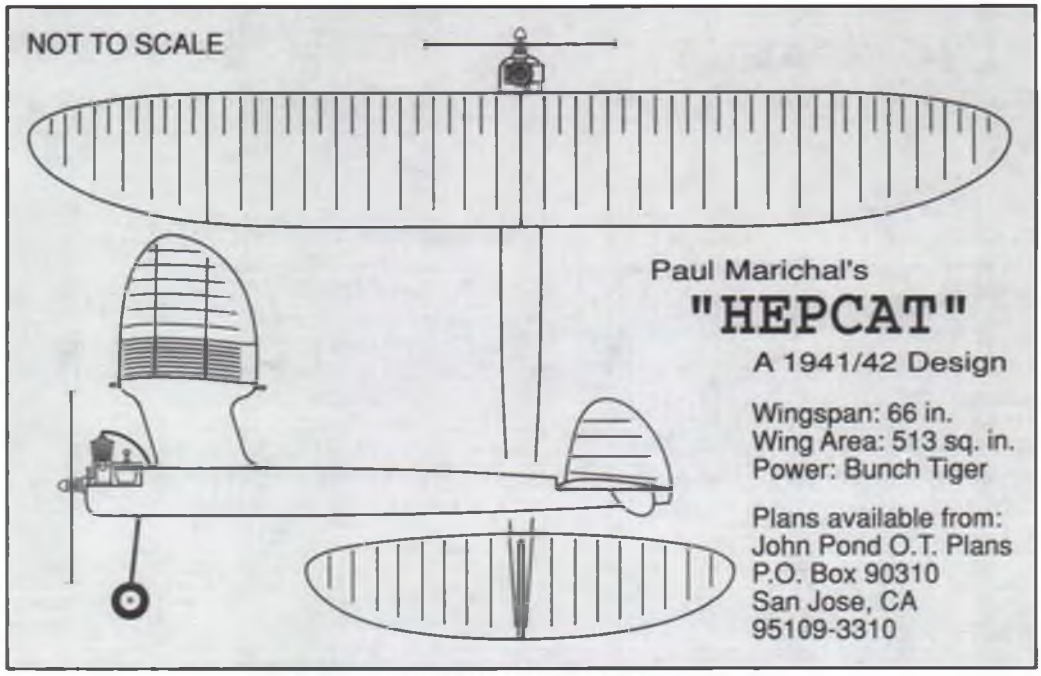
■ LEFT: Photo No. 1. Sharp looking 110 percent Anderson Pylon by SAM 51's Tom Smith has been winning like crazy, including 1st place in Texaco at the recent SAM 21 All-Texaco Two-Day Annual. Engine is a Saito .80 four-stroke with 77 Products spark ignition conversion. ■ RIGHT: Photo No. 2. Bob Munn eyeballs Pond's M-G II, proxy flown by Dave Lewis to a close 2nd place in Texaco at SAM 21 meet. Plenty of power with an O.S. .70 Surpass up front.

Old "2nd Place" Pond was at it again; Bob Munn is seen in Photo No. 2 eyeballing my 9-1/2 foot M-G II, proxy flown by Dave Lewis. Have to admit, the model is an excellent performer. No shame to place 2nd

as it was only the second flight taken on the model! Some designs just naturally fly well.

To prove the point that leisurely or "fun" type events draw participants, Photo No. 3 shows Emilio "George" Finato with a little-seen original version of the Modelcraft Pacific Ace produced back in 1935/36. (This ship had pretty straightforward lines, being the progenitor of a series of rubber-powered designs ranging in span from 16 to 40 inches.) George decided that an economical diesel might be a good engine for Texaco. A Drone diesel was employed and it was a perfect day to use the fixed-compression engine, as the temperature stayed at 75 degrees all day.

The most pleasure this writer derives from the 1/2A events is 1/2A Texaco Scale. These models, built generally in the 280-300 square inch size, fly very realistically. This is what model flying is about! In Photo No. 4, George Joki shows his brand new D.H. 85 Leopard Moth. This aircraft was originally conceived as the replacement for the D.H. 80A Puss Moth so well known to modelers. Another scale model that attracted the photographer was a neat looking Fairchild 22 as built and flown by John Allen and pictured in Photo No. 5.



MODEL OF THE MONTH

Photo No. 6 is displayed to illustrate a point: "Never throw your old RC O.T. models away." Seen in the photo is a beautiful Lanzo Record Breaker as restored by Bob von Konsky. This 10-year-old model had passed through several hands before being acquired by Bob. The model was pretty well worn and oil soaked, but Bob could see it wasn't too far gone. The entire framework was cleaned of oil and grease, which allowed for a new silk covering job. Flies just as well as ever!

ENGINE OF THE MONTH

The first announcement of the radical Aero .35 appeared in the June 1963 issue of *Model Airplane News*. A full-page ad was placed by the Aero Research & Development Co. of Buffalo, New York. The announced price was $34.95 with an optional $5.95 for an RC carburetor.

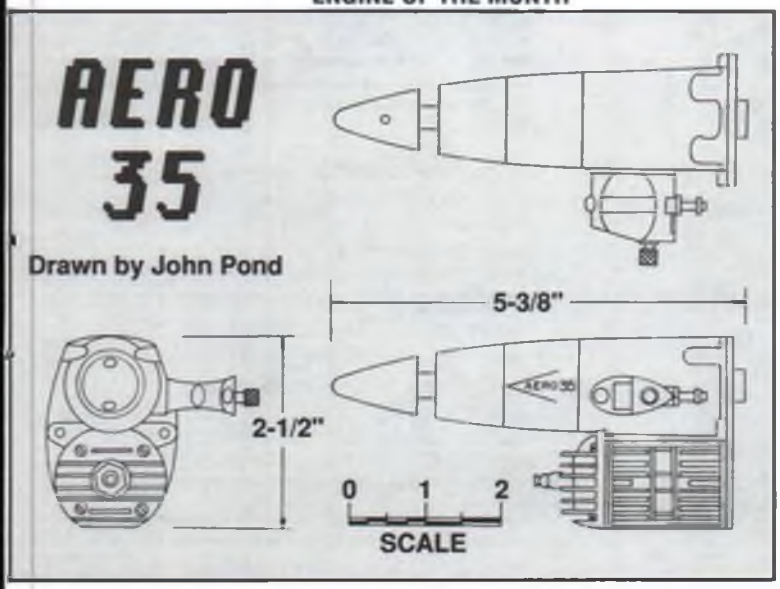
Always the first kid on the block to have something new, this writer immediately purchased one with the intent of flying it at the 1963 AMA Nats at Los Alamitos NAS (California). Other model projects took precedent, though, and I was unable to get an airplane ready in time.

However, at the Nats I was delighted to see that Stan Hill had an Aero .35 mounted in his high-thrustline Amazon. The engine started quite easily and ran very smoothly. Hill and I agreed that the Aero engine had about the power of a Fox .29, which was a bit of a disappointment to both of us. I never did use my Aero engine in a free flight, but rather made plans to build a Dornier DO-335 Pfeil, which featured a push-pull twin engine setup. The Aero engine, being small in overall height, was ideal for a tail-mounted engine installation. However, it was one of several planned projects that never came to pass.

This unique engine featured a bore of .812 inch and stroke of .67 inch, giving a .35 cubic inch displacement. The fore-and-aft moving piston was

Photo No. 4. George Joki produced this little-seen D.H. 85 Leopard Moth for 1/2A Texaco Scale. This design was the follow-on to the Puss Moth.

ENGINE OF THE MONTH



coupled to the rotating crankshaft via a "wobble plate"—not a new concept, but the first such engine to be produced commercially. Truly a shame it failed to catch on, as the engine adapted itself to beautiful streamlined shapes.

No question about it, the Aero was a sensational engine that ran very smoothly. However, most modelers preferred the high rpm, standard piston arrangement despite the increased noise and vibration. Another good idea lost to antiquity!

MODEL OF THE MONTH

In 1941, after the terrific number of entries at the second Chicago Nationals, it became quite apparent to the rules committee and the processing people running the contest that some simplification of the rules were necessary in order to speed up the processing of models.

One of the first items to go was the cross-section rule, which required the fuselage to have a minimum cross-section equal to the length squared divided by 100; for example, a 30-inch long fuselage would require a cross-section of 9 square inches (such as a 3x3 square) at some point along its length. This rule, when thrown out, allowed for very slim fuselages with very high pylons. Known as "Flying Broomsticks" or "Pencil Bombers," a whole new concept of models evolved.

Photo No. 5. Another 1/2A Texaco Scale ship, a neat Fairchild 22 as turned out by John Allen.

Such a model was the "Hepcat" as cooked up by Paul Marichal—one of the group who formed the Langley Brainbusters. This club was composed of those modelers headed for the research program at Langley Field. Probably no other club had as many famous names—Dick Everett, Charlie Folk, Paul Marichal, Frank Parmenter, "Cad" Caldwell, Sal Taibi, Joe Boyle, John Worth, Joe Dodson, and a flock of others.

Photo No. 6. Nice restoration job by Bob von Konsky on this 10-year-old Lanzo Record Breaker. Red silk finish, O.S. .60 open-rocker four-stroke.

Paul Marichal was rather taken by the elliptical wing and tail layout featured by John Drobshoff in his Advanced Co. kit of the Vanguard. As it turned out, with a toothpick type fuselage, this design turned out to be a real winner. Proof of the pudding is seen in Photo No. 7 show-

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ing Paul Marichal winning 1st place at the 1942 Virginia Model Association State Champs on October 4, 1942.

The Brainbusters have continued to hold contests to this date, consisting generally of a Spring and Fall FF Annual. Quite a few of the boys left Langley to work at the new NASA Research Station in Houston. Paul Marichal was one of the group who transferred. Quite a few are still active in modeling.

The Hepcat's fuselage was built on a crutch, popularized by the Skyscrapers in designs like the Pacer, Rocketeer,

Photo No. 7. Paul Marichal receives the 1st place trophy for his hot flying Hepcat at the 1942 Virginia State Champs. The Hepcat is this month's featured model.

Zomby, Yehudi, etc. This style of construction lends itself to accurate and warp-free structures. Correct alignment of the flying surfaces is practically guaranteed. With a planked fuselage, this model is virtually indestructible.

Another desirable characteristic of the design is the high pylon, which gives you an excellent grip on the model when the engine is screaming away.

In closing, there is no disgrace attached to the concept of the "Pencil Bomber" as it was a natural evolution following the elimination of the cross-section rule. Even this writer had a 1946 design known as the Hi- Hatter, powered by an ignition McCoy .60. A real goer!

FREE PLUG DEPT.

Just received a note from Tom Morrison that Super Cyclones are again in production and orders are being filled in the order received. If you're interested in obtaining one of these top quality engines, write to Super Cyclone Engines, P. O. Box 1809, Show Low, AZ 85901. At last conversation, the engines were being sold in the $225 range. Not bad for a brand new ignition engine! ***MB***

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6x3, 6x3.5, 6x4	$1.09	9x4, 9x5, 9x6, 9x8, 9.5x6	$1.59
7x4, 7x6	$1.29	10x6, 10x7, 10x8	$1.79
		11x6, 11x7, 11x7.5, 11x9	$1.99

K Series

black, glass-filled nylon			
12x6, 12x8	$2.29	14x6, 14x8	$5.09
13x6, 13x8	$3.99	15x8, 15x10	$6.09
		16x6, 16x8	$6.89

Classic Series

black, glass-filled nylon			
16x6, 16x8, 16x10	$7.95	18x6, 18x8, 18x10	$13.25
		20x6, 20x8, 20x10	$15.25

Wood Series

beechwood or maple			
9x4, 9x5, 9x6, 9x8	$1.95	14x6, 14x8, 14x10	$5.25
10x5, 10x6, 10x7, 10x8	$2.25	16x6, 16x8, 16x10	$8.95
11x6, 11x7, 11x8, 11x10	$2.55	18x6, 18x8, 18x10	$13.95
12x6, 12x8, 12x9	$3.25	20x6, 20x8, 20x10	$15.95
13x6, 13x8, 13x10	$3.95	22x8, 22x10, 22x12	$17.95
		24x8, 24x10, 24x12	$19.95

NEW! **Scimitar Series**

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BY RON EIGENSCHINK

The Sukhoi 40 From Midwest Products

Russia's famous aerobatic monoplane has become one of the most popular subjects to ever hit the modeling scene. Midwest's .40-size sport scale replica builds easily and delivers stunning performance.

The Russian-made Sukhoi Su-26M made its U.S. debut at the 1989 EAA Convention in Oshkosh, Wisconsin. Five years later it remains the world's premier competition aerobatic aircraft. Nothing has yet come along that can beat it for vertical penetration and rolling capability. You have to see this aircraft go through its paces to really appreciate its awesome power and aerobatic prowess.

THE KIT

The Sukhoi 40 is one of what Midwest calls their Success Series kits, which have established an enviable reputation in the industry for their quality of materials and well-executed design.

As I unpacked the kit I was impressed by the individual plastic bags of parts. Each bag contains those parts for a particular assembly. Rolled plans, an instruction manual, excellent die-cut balsa and lite-ply, hardware, vacuum-formed cowl and canopy and a three-color decal sheet complete the contents.

The instruction manual describes each step in detail. The finishing section explains how to duplicate the standard, rather complex Sukhoi striping scheme. Page 3 contains a kit contents list complete with part numbers, descriptions and dimensions both

Done up in what has become the standard Sukhoi trim scheme, Midwest's Sukhoi 40 is one sharp looking model. Covering on the author's model is Goldberg Ultracote; duplicating the scale trim is fully detailed in the kit's instruction manual.

Living only about a 1-1/2 hour drive from Oshkosh, I'm able to attend the Convention each year. When the airshow schedule is published I make every effort to attend on one of the days that a Sukhoi will perform.

Kit contents are typical of what you'll find in any of Midwest's "Success Series" kits—high-quality materials and truly exceptional die-cutting.

in inches and millimeters (appropriate for a Soviet aircraft). This page is followed by two pages of drawings that show each die-cut piece along with a corresponding number. The last page of the manual contains a product evaluation card. If you fill it out and mail it in, Midwest will send you a current product catalog free of charge.

CONSTRUCTION

The construction manual shows the assembly of the wing first—a logical place to start because you'll need the wing in order to do some fuselage steps.

The die-cutting in this kit is superb! The pieces really do fall out. Very little touch-up is needed—in fact, I didn't have to do anything to the ribs before using them.

Midwest uses a couple of neat ideas in the construction. For example, the leading edge sheeting is first glued only to the leading edge stick with CA, then aliphatic resin glue (Titebond, etc.) is spread onto the ribs, the sheeting is rolled over the ribs and then glued to the spar with CA. The CA therefore becomes a clamp that holds the sheeting in place until the aliphatic glue dries.

Another neat idea is that the rib capstrips are die-cut on the rib sheets—using up material that would otherwise be wasted.

A tapered wing construction brace is included in the kit, for use when turning the wing over and building the opposite side, and also when gluing the two wing halves together. It's a nice touch, eliminating the need to scrounge anything and everything in order to build a tapered wing on a flat surface.

The majority of the fuselage is built of lite-ply. Here again, the die-cutting is super, with little or no touch-up needed. The sides, top and bottom have a fair amount of lightening holes in them and the punch-outs created quite a pile on the bench.

The basic fuselage box is of notch-and-tab construction and is hard to mess up if you follow the instructions. You'll wish you had a couple of extra hands to hold everything together while lining up, taping and checking for squareness before gluing.

I found a few items in the fuselage construction that leave room for interpretation. For one thing, I could find no indication as to the position of the engine. The plans don't show an engine and the construction manual offers no recommendations. Taking a conservative approach, I chose to mount the engine upright.

Climbing out from the author's home field in rural Wisconsin.

MIDWEST'S SUKHOI 40

WINGSPAN	54 in.
WING AREA	521 sq. in.
FLYING WEIGHT	5-5.5 lbs.
WING LOADING	22-24 oz./sq. ft.
ENGINE	.35-.45 two-stroke .40-.50 four-stroke
RADIO	Four channels required
SUGGESTED RETAIL	$134.95

Produced by Midwest Products Co., 400 S. Indiana St., P.O. Box 564, Hobart, IN 46342. (219) 942-1134.

Of course, only after the engine was mounted did I discover that my stock O.S. muffler wouldn't fit without cutting a large opening in the side of that neat cowl. I tried several different aftermarket mufflers, with no success. Examining the Sukhoi 40 on display in the Midwest booth at one of the trade shows, I saw they had mounted the engine so that the muffler exits between the landing gear legs. The large cutout is therefore hidden beneath the aircraft.

Since I had already drilled the firewall and mounted the engine, I wasn't about to make a change now. My local hobby dealer solved the problem by suggesting a muffler extension made by O.S. It worked perfectly! I now have an upright engine and only a small hole in the side of the cowl.

Another item not addressed is the filler block located above the landing gear.

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Two views of the complete but uncovered structure reveal the strong, straightforward construction. Engine is an O.S. .46 FP. Bent aluminum gear simulates the full-size aircraft's lightweight titanium gear.

This block is shaped along with the fuselage block directly in front of it, however, nowhere does it indicate how this block is fastened to the landing gear, or if it is fastened at all. I chose to make the block part of the landing gear hold-down, sandwiching the landing gear between it and the fuselage.

The manual tells you to install the three cowl blocks as shown on the full-size firewall pattern on the plan. Thing is, the full-size firewall drawing doesn't show cowl blocks. The instructions do tell you to position the blocks 1/8-inch beyond the edge of the fuselage, but after doing this I found the blocks were actually out too far, and to make the cowl fit the way it should, they needed to be "adjusted." No big deal.

The cowl is made in two halves—not left and right but front and back. A molded-in notch not only adds strength but also makes for an exceptionally good fit that requires very little extra work to make it look presentable. The manual also gives a hint about strengthening the cowl, however, it seemed to me to be strong enough as is, and to date has not given any problem.

FINISHING

A final sanding and filling followed by another sanding and the Sukhoi was ready for covering. I chose to do it in Goldberg's Ultracote—white for the entire airframe with red trim. Following Midwest's directions, an authentic Su-26 color scheme was easily duplicated. I found it best to apply the decals and then add the red trim stripes; this way, I was better able to line up the red trim without having to worry about leaving room for a decal. I was really impressed with the results

FLYING

Ground handling on this model is excellent. Typical of taildraggers, a little up elevator is needed to plant the tail. No rudder was needed on the takeoff run and in about 15-20 feet the Sukhoi jumped into the air. If you want to make a long takeoff run with this bird you'll have to work at it! A little elevator and rudder trim were needed, but that was it.

Loops are straight and clean and size is no object. If you want large ones you make large ones; if you want small ones, just pull more up elevator.

Single rolls are crisp with no elevator needed. Point rolls show a little positive roll coupling when rudder is applied, however, once you're aware of it, compensation is easy.

Knife-edge flight can be accomplished from one end of the field to the other. Plenty of rudder is available and only a slight amount of up elevator is needed to keep a straight line.

Spins can be induced with elevator and rudder alone—no aileron needed. Snap rolls are excellent with no tendency to overshoot the roll. We even tried several Lomcevaks—unsuccessfully. Maybe a CG adjustment will help.

Landing approaches are rock solid and fast. We found that the little Sukhoi wouldn't slow down at anything above idle. A good, slow idle is essential in order to make slow approaches.

In summary, *I love this little airplane!* I'd recommend it to anyone. If you are reasonably proficient with an aileron trainer you'll be able to fly this one. I'm going to keep mine around for a long time! ***MB***

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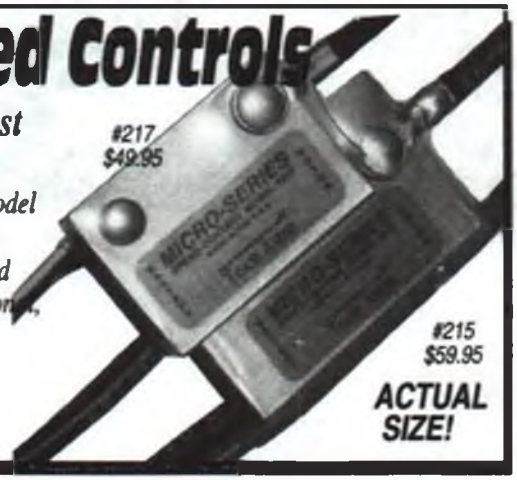

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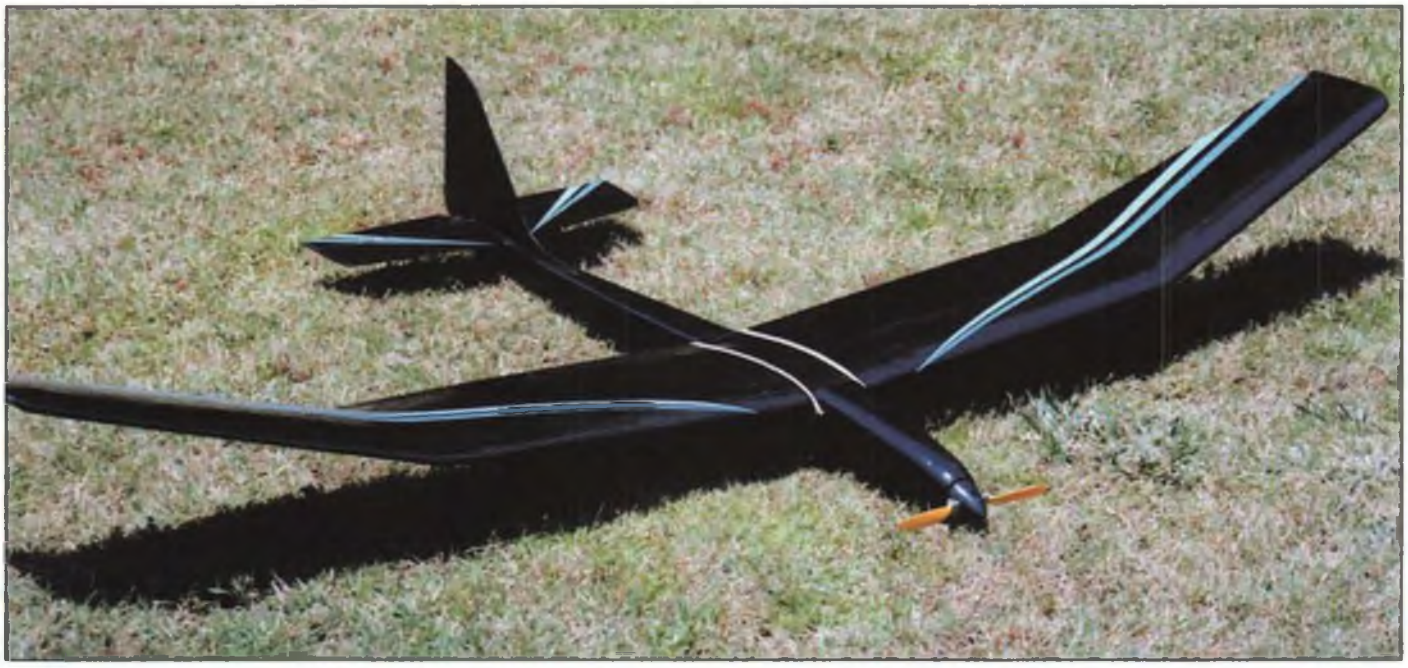
BY CRAIG LACHANCE

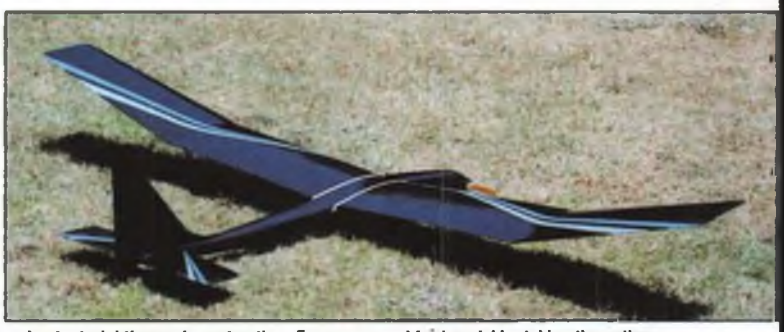
Davey Systems' 'Vengence' Electric Sailplane

A relatively new entry in the seven-cell electric sailplane market, the Vengence offers excellent performance and the added bonus of being able to carry up to 12 cells, for those who want to experiment with larger power systems.

At the top of the climb you push the nose over slightly, just as your finger finds the transmitter switch to turn the motor off. It's too high to see the prop fold, but the sudden absence of the motor's faint whir confirms it's no longer pulling. Pretty far out and going away, so you turn it to bring the plane across your vision, from right to left. A good perspective to gauge the glide angle. Very impressive, especially for a 2-meter!

Feeding in a few clicks of down trim, you can see the speed increase a little. Three more clicks and it's really moving now, with no perceptible steepening of the glide attitude. Finally, with the trim lever against the stop, we're diving; zoom back up until the speed decays and we'll explore the





Before and after covering photos of the author's Vengence. Photo at top illustrates the model's robust, straightforward construction. Frame-up went fairly quickly, taking the author only 12 hours to get it to this stage. The model was originally covered in black Coverite 21st Century fabric, but wing flutter forced a change to a more rigid plastic film—in this case, Oracover from Hobby Lobby.

CELL COUNT VS. OVERALL PERFORMANCE

Upping the cell count is an easy and obvious way to increase climb performance, but doing so also brings other factors into play. The increase in weight, although not affecting the glide ratio, does affect the stall speed as well as the sink rate.

What kind of real-world effect did carrying 12 cells have on the Vengence's flying abilities? Well, I wouldn't characterize the change as drastic, but it *is* significant. The model seemed to lose the lower 15 percent of its considerable speed range; the Gentle Lady-like float was gone, as was its ability to hold its nose up to shorten the approach before touchdown. As the wing loading had gone up by almost 1/3, from 10.9 ounces per square foot to 14.2, that's understandable.

What you get for this tradeoff is a steep, fast climb. Be careful in comparing these performance figures with the seven-cell tests, though; there's more going on here than just hard numbers.

CLIMB RATE (FEET PER MINUTE) WITH DIRECT DRIVE GRAUPNER SPEED 700 TURBO*

Climb #	8 cells, 10x6 Folder	10 cells, 10x6 Folder**	12 cells, 9x5 Rev-Up**
1	660	820	900
2	600	760	820
3	500	560	580 (50 sec.)
4	340		
Total Motor Run Time:	4:00	3:00	2:50
Total Altitude Gain:	2100 ft.	2140 ft.	2300 ft.
Dead-Air Time:	21:12	19:56	20:25
Weight:	54.7 oz.	58.6 oz.	62.6 oz.

*All climbs were 60 seconds except as indicated. All cells were 1700-mAH SCRs.
**These are the totals of two 30-second climbs. Per Graupner's instructions, the Speed 700 Turbo is limited to 30-second runs at these voltages.

other end. Trim lever at neutral now and coming back . . . three clicks—getting slower; trim all the way back and a little porpoising starts. Still no stall, but it must be getting close. Dampen the oscillation with a touch of down and let the speed stabilize. It's now floating around at about the same speed and sink rate of a 2-meter floater. Pull back on the stick slowly to induce the stall and it finally comes; a touch of down and it's flying again. Whew, amazing! These modern airfoils really are worthwhile!

The all-wood Vengence was designed to be an inexpensive seven-cell electric sailplane that will take a variety of propulsion systems and deliver high performance at the 2-meter level. However, the cavernous fuselage and robust construction allows up to 12-cell packs and the use of stronger motors. The S3021 airfoil provides a great lift/drag ratio and wide speed range. The Vengence can be purchased as 1) a bare kit without motor; 2) with a direct drive ferrite

THE VENGENCE FROM DAVEY SYSTEMS

WINGSPAN	78.5 in.
WING AREA	635 sq. in.
FLYING WEIGHT	48.1 oz. as tested
WING LOADING	10.9 oz./sq. ft.
AIRFOIL	S3021
ASPECT RATIO	9.7:1
MOTOR	05-15, 7-12 cells
SUGGESTED RETAIL	$59.95 (kit alone)
	$99.95 (kit with direct drive motor/prop setup)
	$109.95 (kit with geared motor/prop setup)

Produced by Davey Systems Corp., 675 Tower Lane, West Chester, PA 19380; (215) 430-8645, FAX: (215) 430-0186.

PERFORMANCE WITH DIFFERENT MOTORS

Bench-testing electric motors yields data useful for comparing motors on the ground, and no one appreciates what has been published along those lines more than I. But the fact that you don't see many flying benches has always made me wonder just how the numbers on the ground translate to performance in the air. Does a stronger motor yielding a steeper climb overcome a shorter duration to provide a higher overall climb per charge, or do you always sacrifice total altitude for vertical speed? And what about gearing versus direct drive?

Trying to eliminate as many variables as possible, I mounted a number of different motors in my Vengence and made climb tests using the same battery. The results of the best of each type are shown in the table. And yes, any or all of these performance figures could probably be exceeded by experimenting with different props.

These tests were always begun soon after dawn. Climbs were recorded in 60-second segments to not only provide rate-of-climb for each minute of motor run but also to be able to visually maintain the best airspeed and climb angle (hard to do at 2,000 feet!).

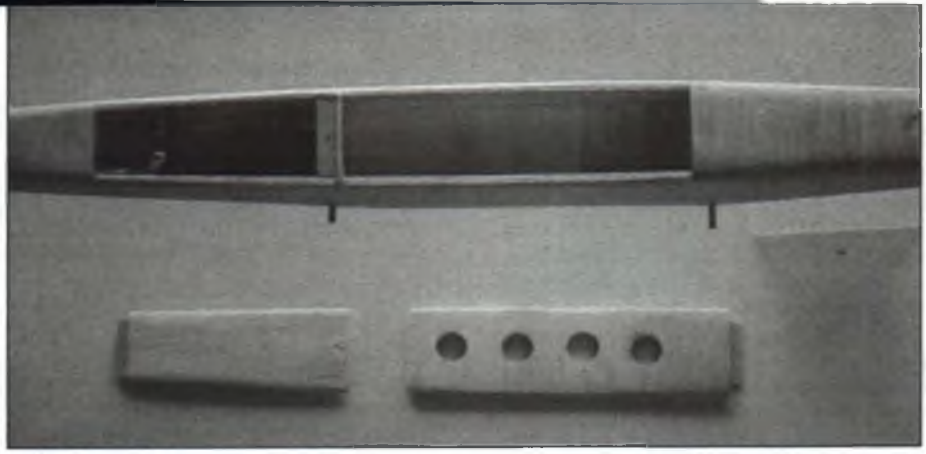
With a Casio altimeter watch recording the craft's height to within 20 feet, the only other variables left to deal with were undetected vertical air movements, changing air density, temperature variations affecting pushrod lengths (thereby changing elevator trim and sink rate), and excessive or erratic stick movements.

Which, when all things are considered, may be reason enough to keep your eyes peeled for those flying benches, after all.

CLIMB RATE (FEET PER MINUTE)*

Climb #	Hyperthrust B75 (direct), Sonic-Tronics 8x4 folder**	Astro Flight 05 cobalt (direct), 8x5 Rev-Up	Astro Flight 05 FAI (direct), 8x5 Rev-Up	Hyperthrust B75 (geared), 12x8 Windsor folder**	Astro Flight 05 cobalt (geared), 12x8 Windsor	Astro Flight 05 FAI (geared), 12x8 Windsor
1	520	700	720	620	900	940
2	400	620	680	560	840	900
3	360	600	420	520	720	560
4	220 (50 sec.)	160 (35 sec.)	440	280 (38 sec.)		
5				160 (35 sec.)		
Total Motor Run Time:	3:50	3:35	3:00	4:35	3:30	3:00
Total Altitude Gain:	1500 Ft.	2080 ft.	1820 ft.	2300 ft.	2740 ft.	2400 ft.
Dead-Air Time:	17:35	21:45	18:34	25:03	28:32	25:35

*All climbs were 60 seconds except as indicated.
**These are the motor/prop combinations as supplied in the Vengence kits.



Bottom view of the uncovered fuselage shows the two access hatches; one on the left was added by the author for access to the servos and receiver. Fuselage is cavernous, with plenty of room for two seven-cell packs. If you're inclined to experiment with larger motors such as the Graupner Speed 700 Turbo (about $25 from Hobby Lobby).

motor and folding prop; or 3) with the same motor in a geared configuration and a larger folding prop. I built and tested it with both the direct drive and geared motors as supplied in the kits, as well as with the popular Astro Flight cobalt 05 motors.

CONSTRUCTION

The kit is quite complete, with all of the usual needed hardware included. Wood quality and selection are reasonable, density and hardness ranging from medium (for most everything) to hard (wing leading edges). The turbulator spar notches in the ribs could be a better fit, but otherwise the die-cutting and machining are for the most part very good to excellent.

One thing I would like to see included in the kit: sticky-back Velcro (as suggested in the instructions) for mounting the radio and motor batteries and receiver.

The plans and instructions are clear. Included in them are diagrams and former templates for installation of the geared version of the kit motor (Hyperthrust II 075) as well as for the Graupner 700 series motor installation. (Motor mount formers come cut for the kit motor on direct drive.)

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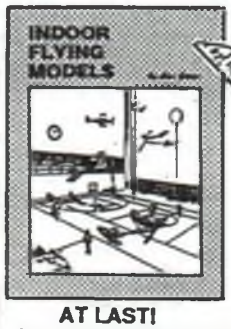

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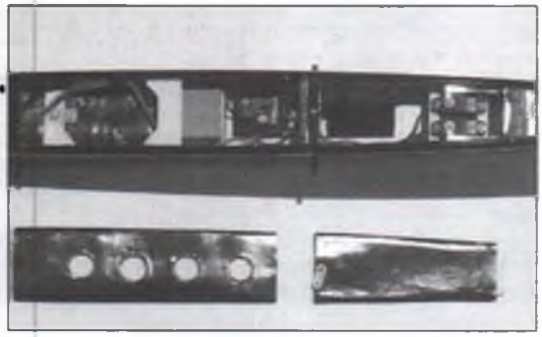
One version of the Vengence comes with a Davey Systems "Hyperthrust" 075 motor for a seven-cell direct drive setup, but the author recommends going with the slightly more expensive geared system for a much improved climb.

Framing the structure goes quickly and easily. CA thick and thin adhesives were used throughout, with aliphatic wood glue used to double-glue the junctions of wing spar caps, shear webs and ribs. The only thing that seemed more difficult than it needed to be was the use of 1/16-inch music wire to join the elevator halves. To



Radio and motor battery installation in the belly of the Vengence. Here the receiver is mounted with Velcro in the rear of the motor battery compartment for proper balance with direct drive motors; when using heavier geared motors, the receiver is moved aft to the spot of Velcro just forward of the servos.

accept the wire, a hole about an inch deep must be drilled into the edge of each half, which is only 5/32-inch thick. If I hadn't had a drill press to insure a straight hole I might have substituted a 5/32-inch wood dowel or a plywood block.

I deviated from the prescribed construction in a few areas of personal preference: 1) A removable hatch cover was made aft of the wing to allow access to the servos and receiver; 2) Sullivan pushrods were substituted for the balsa stick pushrods supplied; and 3) An aluminum motor mount replaced the kit's plywood bulkhead, solely to make it easier to fit the different propulsion sys-

continued on page 73

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TRAYS VITE *continued from page 55*

fudge is to use a heavier or lighter nosewheel.)

Glide the model, over tall grass if possible. Aim its nose at an imaginary spot 25-30 feet away and give it a fairly good shove. Bend the control surface tabs until you get the longest glide possible.

If electric, run the battery nearly dead before you toss the model. The battery's major thrust will peter out rapidly, although the motor may run quite a long time just ticking over.

With the Cox, limit the motor runs to no more than 20 seconds and reduce the thrust by installing the propeller flat side forward. Don't try to cut engine thrust by running rich; it may finish up with a screaming leanout that can zoom up out of sight or spiral sickeningly into the ground.

During adjustment hops the model will turn one way or the other. The ideal turn is shallow and to the left. Don't try to make it fly in a straight line. Correct any stalling tendency by adding downthrust, *not* by adjusting the elevators.

Flying is what it's all about. Get out and fly. Tweak your adjustments. Try anything. Remember, even write down, what happened when you did what. Take it from me; if you don't crash now and then, you're missing something.

Rudder-Only RC Installation

You can control TRAYS VITE for minimum bucks by installing a Cox FailSafe unit. The FailSafe radio reduces overcontrolling, the major cause of beginners' crashes, by limiting the length of time you can deflect the rudder. Even if you freeze on the control, it goes back to neutral after 1 second. Once you've learned to fly with the FailSafe as it comes out of the box, you may want to follow the Cox instructions and bypass the 1-second timing capacitor. This allows you to hold right or left rudder for as long as you wish—useful for maneuvers like snap rolls, spiral dives and quick recovery from either.

With an already proven free flight on hand, the conversion to rudder-only is fairly simple. All you need is a couple gobs of Goop household cement or hot-melt glue to hold the unit in place. Remove the right-hand rudder, armor it with a holed U-shaped clip of tin can metal to receive the control cable end, and remount it with a couple of Du-Bro hinges. Leave the other rudder as is for a trimmer. (The complete installation is detailed on Plan Sheet #3.)

The .049 Powered, 2-Channel TRAYS VITE

The main difference between this and the .020 model is a more rugged wing and a different set of tailfeathers. Everything else is the same, but it's a good idea to beef up the front part of the fuselage by lining it with 1/32 sheet balsa set in CA.

The thicker, stronger wing is easy to throw together. Both the top and bottom surfaces of the wing are glued up from

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flat tray sections. Always use a strip of balsa between the edges of mating panels. As with the original single-surface wing, you can use more or fewer pieces than shown.

Take the bottom surface of the wing and trim one edge straight. Glue on the balsa leading edge and the main spar. A strip of 3/32x1/4 behind the leading edge forms a gluing shelf for the top cover. Make a half-thickness vee score across the middle of the leading edge, wing panel, main spar and the as yet unattached balsa trailing edge piece, but *do not* glue the T.E. in place yet.

The angle cuts of the leading edge and spar allow the wing dihedral to be bent in. Do so now, clamping the liberally glued main spar joiners in place. You now have the bottom surface of the wing assembled, complete with dihedral.

Rest one side of the wing on a flat surface and prop up under the dihedral of the other side to hold it steady. The upper wing surface is assembled the same way as you did the bottom, but as two separate panels. Glue one of the upper panels to the shelf on the back side of the leading edge. Use pins to hold it in place until it sets, then run a bead along the top side of the bottom cover's trailing edge and bend the top cover down over the spar to generate the airfoil curvature. Weight the assembly down until everything is solid. Now tip the wing the other way and do that topside as well. You must insert the airfoil-shaped filler blocks in the center section before fitting the second top panel in place. Bevel the end of this panel to fit the unbeveled end of the panel already in place to make a neat fit at the center section.

With a good straightedge and razor blade, trim the back edges of the now assembled upper and lower wing panels and glue on the balsa trailing edge. Fill in the wingtips beyond the ends of the spars with layered tray foam and shape with 180-grit sandpaper. Reinforce the center section with cloth decorator tape.

If possible, have TRAYS VITE test flown by an experienced pilot who can check the trim and balance. If you've screwed something up, an old salt has a much better chance to get it back down in one piece.

Confine your first flight activity to keeping the plane in a 200-300 foot circle at an altitude of 200 feet or so. When the engine quits, hold TRAYS as level as you can. The nose will drop in the glide. Pull it up with the elevator trim but don't overdo it and stall. I like to adjust the rudder for a gentle hands-off, nose-down turn. In the rare event of a radio failure, the plane will then spiral down instead of bee-lining over the hills and far away.

Are you having fun yet?

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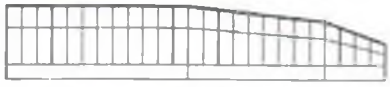

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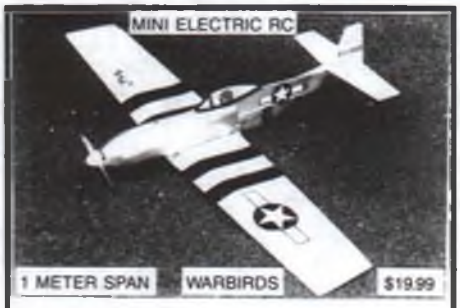

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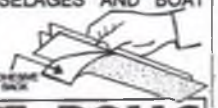

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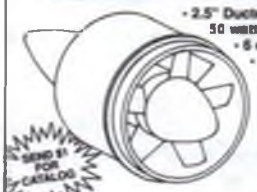

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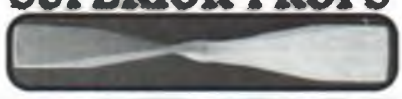

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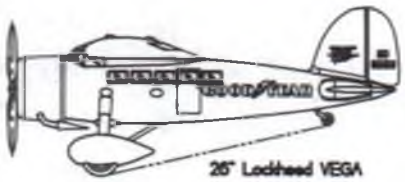

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VENGENCE *continued from page 67*

tems I planned to try.

RCD HS 80 micro servos on the rudder and elevator and a Graupner Pico-Mos 33 motor controller with BEC were installed along with an RCD 535 FM micro receiver. The motor battery is a seven-cell Sanyo 1700-mAH SCR pack.

My entire model was covered with Coverite's 21st Century fabric, with the trim painted on. It's not a lightweight covering, but with the direct drive setup I was pleased when my plane came in at 48.1 ounces complete. Even with the gearbox and larger prop installed it was still under 49 ounces.

FLIGHT PERFORMANCE

Impressions from the initial flights were a mixed bag. On the plus side, climbs on the geared motor (the first setup tried) were more than adequate, allowing six climbs to hi-start height and 25-minute dead-air times on a single charge. The glide was excellent, with a speed range nothing short of remarkable. Handling was good, with no problems making tight turns to center those little bubbles. It also indicated lift well.

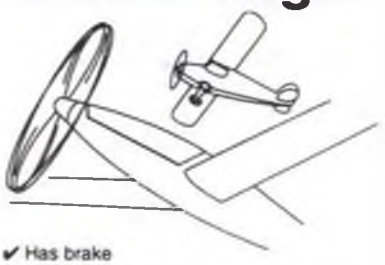
The disappointment was in the wing's propensity to flutter. And not just in dives; with any of the stronger motors installed the wing would flutter in the climb if the nose wasn't kept high enough to hold the airspeed down. Mr. Davey suggested the covering was the culprit, the fabric not providing enough torsional rigidity. Having seen this problem in other wings of similar construction, I doubted a covering change would cure the problem, however, re-covering the wing with one of the stiffer films (Oracover, purchased from Hobby Lobby) did indeed do the trick and there is now no flutter problem at all. The necessity of using a stiff covering is something that should be stressed in the kit's instructions.

OVERVIEW

Two-meter powered gliders are popular for good reason. They are easily transported with a one-piece wing, are relatively inexpensive to build, and they can utilize cheaper and more easily charged propulsion systems. The Vengence adds to these attributes the promise of excellent flight characteristics and performance, with the convenience of not having to take the wing off to change the battery. Plus it has the room and strength to accommodate a variety of power systems.

The Vengence kit that includes the geared motor setup is a good value and will provide a climb you'll be pleased with. Personally, I would pass on the direct drive version. Or, if forced to go direct drive, I would purchase the bare kit (no motor) and power it with one of the stronger aftermarket motors and battery combinations to make the ride up as exciting and impressive as the rest of the Vengence flight regime. ***MB***

Electric Flight



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X-CELL 60 *continued from page 47*

hover, the panic mode is usually pulling the throttle stick back rapidly; too much negative pitch would immediately drive the model into the ground.

Normally, when a model helicopter is trimmed to hover perfectly still, the trims will not be correct for high-speed forward flight; the model will tend to bank and yaw to the right. When you roll it over for switchless inverted, the model will tend to bank to the left and pitch up.

Programmable mix functions are used to help make the X-Cell 60 fly hands-off in hover, forward flight and inverted flight. First, I trim the model for hands off hover, then, I use the programmable mix to make the model fly straight and level in forward flight with the idle-up on. Idle-up is turned on as soon as the model accelerates to about 10 mph. Table 1 shows the five programmable mixes I'm using on my Futaba 9ZHP for my X-Cell 60.

These mixes are automatically activated when idle-up 1 or 2 is switched on. Programmable Mix 1 (MX1) feeds in a constant 2 percent forward cyclic to keep the nose down for level forward flight. The amount is determined by flying at medium speed (half throttle) and adding the necessary forward cyclic offset to give hands-off level flight.

MX2 gives linear mixing between the throttle stick and left/right cyclic. A maximum of 2 percent left cyclic is fed in when throttle stick is raised above half throttle. This prevents the model from banking to the right in forward flight. MX2 also gives up to 7 percent right cyclic when the throttle stick is pulled all the way back for switchless inverted flight; this helps keep the model level when inverted. (Model helicopters with a clockwise rotating main rotor will bank to the left in inverted forward flight.)

MX3 gives a U-shaped rudder mixing; the 24 percent makes the tail rotor blade pitch become positive in switchless inverted flight. The tail rotor pitch is increased by only 4 percent when the throttle stick is raised above half stick because in forward flight, very little right tail rotor pitch is needed. The vertical fin helps keep the model flying straight.

MX4 gives 3 percent back cyclic stick to prevent the model from climbing when the throttle stick is pulled back for switchless inverted flight. MX4 also gives 1 percent forward cyclic stick to help keep the nose down while at full throttle. Remember, MX1 keeps the model level in forward flight at half speed only; MX4 makes the model fly level at half throttle to full speed. This is an important distinction.

MX5 kicks the rate gyro into a low rate setting when idle-up is turned on. A dual rate gyro such as the Futaba 153BB, JR 120, Airtronics SG-I, JMW or Zeal must be used. Plug the gyro sensitivity select pigtail into channel 5 of the receiver. Leave the gear selector switch at high rate for hover. When you go into forward flight aerobatics, flipping on the idle-up triggers the gyro into low rate.

On radios with only one or two programmable mixes, I recommend using them to mix throttle stick and fore/aft cyclic (like in MX4) and throttle stick and left/right cyclic (like in MX2). A U-shaped tail rotor mix is nice, but if 5-10 percent rudder offset is used and the gyro is working, then even in switchless inverted, the yaw motion will be very stable. It's more annoying to have a model that dives or climbs in right side up or inverted forward flight. MX4 is especially useful for doing a half-roll from upright into switchless inverted because once inverted, pulling the throttle stick back automatically tucks the helicopter's nose down slightly. Table 3 shows the programmable mixes for Futaba's Super 7 radio.

A nice side benefit of mounting the X-Cell's fore/aft servo behind the main rotor shaft is that it automatically gives some aft cyclic when the swashplate is lowered for negative pitch. This mechanical coupling is purely due to the geometry of the eleva-

TABLE 3—PROGRAM FOR THE FUTABA SUPER 7 RADIO WHEN USED IN THE X-CELL 60

Note: The program for the Airtronics 660 and JR x-347 and X-388S is similar. When using the older Futaba 7UH, which has only one idle-up, use the throttle curve and pitch curve for idle-up 2. Even without a U-shaped tail rotor mix, when the proper amount of rudder offset (R-DL) is used, the model will not yaw suddenly when switching into idle-up in forward flight. This also implies that the model will hover switchless inverted without needing a U-shaped tail rotor mix.

Dual Rate 1	85%
Dual Rate 2	85%
Dual Rate 3	90%
Exponential Ch 1	-12%
Exponential Ch 2	-16%
Exponential Ch 3	-8%
PMIX 2 6	2% up (gives forward cyclic in upright forward flight) +2% down (gives aft cyclic in switchless inverted flight)
or	
PMIX 1 6	+2% up (gives left cyclic in upright forward flight) +7% down (gives right cyclic in switchless inverted flight)
or	
PMIX 4 6	-20% up (U-shaped tail collective mixing) -25% down
T-NR	0-30-43-75-100
T-ID1	60-38-46-80-100 (Beginners don't use)
T-ID2	100-44-48-85-100 (Beginners don't use)
P-NR	15-47-64-72-90
P-ID1	9-38-61-70-88 (Beginners don't use)
P-ID2	0-32-57-70-87 (Beginners don't use)
P-HD	7-45-63-75-100 (Beginners don't use)
HV-T	ON
HV-P	ON
ID-H	100%
NR-L	100%
Revo 4 6	-35% up, -30% down
R-OF	5%
R-DL	80%
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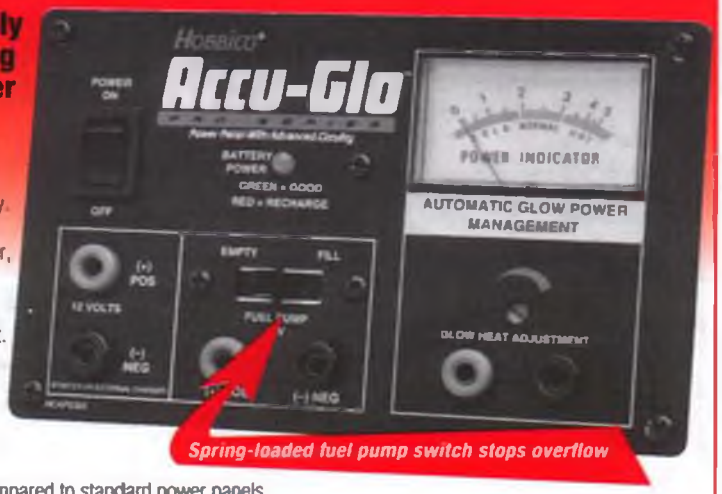

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The numbers given in Table 1 should be used only as a starting point. They will need to be fine tuned for your model because each model will have a different swashplate and collective pitch travel range. Always check to make sure that when idle-up is on, as you move the throttle stick, the cyclic and tail rotor mixes are moving in the proper direction. Don't just program in the above numbers blindly. Check the direction for your particular model! These program settings should be tried only by pilots who are comfortable with forward flight.

CONTROL SETUP

An X-Cell 60 built exactly per the instructions will give at least -4 to +10 degrees of collective pitch travel, and plenty of cyclic and tail rotor control. For switchless inverted flying and extreme 3-D hotdogging, you will need to fine-tune the pushrod lengths. When properly set up, the physical numbers in Table 2 should correspond to the collective and throttle curves of Figures 1 and 2.

To get the +9 to -9 degrees of collective pitch in idle-up 2, the two pushrods from the roll servo to the two 90-degree bellcranks are each shortened by 8 turns, the two pushrods from the 90-degree bellcranks to the swashplate are each lengthened by 8 turns, and the two pushrods from the fore/aft control lever (which slides up and down on the main shaft) to the swashplate are each lengthened by 8 turns. This done, the 90-degree bellcranks will have equal travel about the horizontal position and the swashplate won't bump into the main rotor shaft top bearing block.

Make sure there is no binding anywhere in the control system at extreme throttle stick positions, combined with full cyclic stick input. The fore/aft control lever must not be able to contact the lower or upper main shaft bearing blocks. If it does, adjust the length of the pushrods from the two 90-degree bellcranks to the swashplate.

At full collective and full cyclic, there will be a slight binding between the sliding washout arms and the main rotor hub. The ball link on the L-arm for the flybar will also bump into the main rotor hub. Try to minimize the binding at both ends equally. My standard X-

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Cell 60 flies extremely well with the stock short main shaft, and stock parts.

Wiggle the Hiller control paddles to check for slop; if everything is set up properly, there should be very little play. Now disconnect the ball link at the cyclic servo (do this for the elevator and aileron servos separately). Move the control paddle to see if it's too tight or too loose. If it's too loose, probably a ball link is sloppy; if it's too tight, it usually means one or more ball links are too tight. Replace the offending ball link(s) so that the control paddle moves smoothly with very little play.

One item I suggest for X-Cell owners is a pair of Miniature Aircraft's weighted Hiller paddles (#0561). I use all five of the supplied brass weights and the flybar weight, too. Together, they make the X-Cell even more predictable.

X-CELL ACCESSORIES

Once you've become comfortable with the way your standard X-Cell 60 flies, try some of the many accessories available. For example, X-Cell distributors and dealers offer the following from Miniature Aircraft USA:

- A new servo tray brace(#0535) provides greater servo tray rigidity.
- Machined aluminum, gold anodized adjustable roll bellcranks (#0536) replace the stock plastic bellcranks (#0167) and allow up to a +/-10 percent variation in swashplate deflection.
- The Pro adjustable Bell mixing kit (#0538) includes machined aluminum mixing arms with dual ball bearings.
- A graphite tail rotor pushrod kit (#0544) replaces the standard wire tail rotor pushrod to minimize flexing under load.
- A machined aluminum washout hub (#0571) more precisely fits the main shaft, eliminating slop and offering slightly increased pitch travel.
- A graphite landing gear set (#0574) saves 2 ounces over the stock gear and includes pressure-formed struts and slotted aluminum skids.
- A dampened start shaft bearing block (#0673) isolates and dampens high frequency vibrations of the upper clutch start shaft; it includes high-rpm needle bearings with Viton seals and fits all X-Cells with a 6.0mm start shaft and rigid clutch system.
- The Pro II Delta flybar system (#0572) allows three position choices for the Bell-Hiller mixing ratios.
- A no-load front transmission mounting kit (#0531) fits all X-Cells and allows full tightening of the 3mm transmission screws without binding the bearings.
- An autorotation thrust bearing (#0534) replaces plastic washer #0211 for improved gear mesh and maintains a more constant slipper clutch adjustment.
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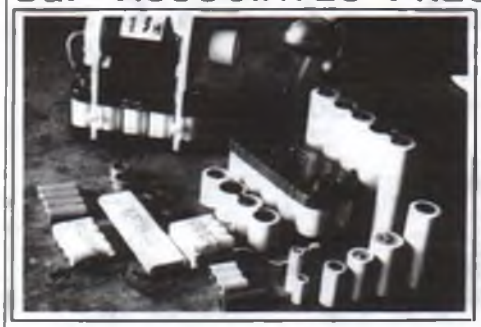

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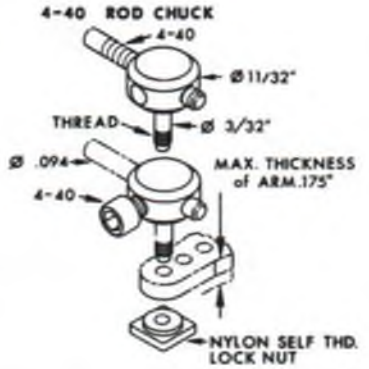

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FREE FLIGHT *continued from page 34*

is the wimpy needle valve assembly. Original equipment included a tapered 3-48 threaded brass shaft with a knurled knob on one end. It was generally marginal for adjustment using a suction feed fuel system. With the resurgence of the Hornet as the engine of choice in the competitive 1/2A Nostalgia event, some kind of improvement was needed.

Before I learned that Doug Galbreath is producing a collet type needle valve assembly (which really does the trick, according to Bruce Augustus), I discovered the Ace R/C needle valve assembly for the Cox .049/.051. This is very similar to the KK unit in that it has 128 threads per inch, but it has a ring mount of nylon, not brass. I bought one (under $5 at my local hobby shop) and cut the nylon part away with a Zona saw, leaving just the brass spray bar. Next, I took the Hornet spray bar out of the case and inserted the modified Ace unit. Perfect fit!

To properly seat the new spray bar in the Hornet case, I used a Dremel with a tapered stone to open up the outside half of the left (viewed from the top) spray bar opening on the Hornet case. The next step was to epoxy the assembly in place using Hobby Poxy thixotropic epoxy, making certain the fuel port in the spray bar was pointing toward the intake slot in the crankshaft.

After the epoxy had cured, I soldered a washer onto the side of the spray bar on the side that the needle enters. The needle was installed using a piece of silicone fuel tubing to prevent air leakage and to keep the needle from rotating when the engine is running. The end result was as expected—much more accurate adjustments and more consistent engine runs, both on suction and when using a pacifier pressure fuel system. Try it!

AEROGLOSS FUELPROOFER

If you're like me, you use some form of fuelproofer over your doped finish. Typically, I use Hobbypoxy or K&B Super Poxy on the nose of my gas models, and use Aerogloss fuelproofer on the wings and stab. The Aerogloss doesn't protect against straight shots of high-nitro fuel, but does give a glossy finish and makes cleaning an easy task.

Recently I used up my last bottle of Aerogloss fuelproofer and dropped by my local hobby shop to buy some more. When I brushed it onto a new tissue-covered wing I immediately noticed that the consistency and smell were different from the previous bottle. When it dried, it blushed the surface and did not give a glossy finish.

The new formula fuelproofer is evidently a replacement for the old, as it has the same number (#87-4). It can be identified by the words "Contains No Lead," which appears on the bottle cap and in very small print on the label's black band.

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I didn't test this new formula for its fuelproofing qualities; it may be as good or better than the old formula.

If you use the new formula, please let me know what you find—maybe you'll have a different experience. Just be forewarned and don't be surprised at the difference.

NYROD AND 2-56 SCREWS

Did you know that the inner plastic tube that RC folks use for pushrods are exactly the right size to accept a 2-56 bolt? This is useful for us free flighters in that you can use a small length of this tubing in place of 2-56 blind nuts. I use Nyrod tube to hold engine and/or dethermalizer timers in place, to mount the engines on my .010 ships and for any other use where small size and light weight are important. The tube fits snugly into a 1/8-inch diameter hole and can be held firmly in place with a couple drops of CA. The 2-56 screw will self-tap into the Nyrod and can be screwed in and out many times before the threads give way. In that case, drill out the worn tube and insert another. Easy and inexpensive, eh?

KEEP YOUR POWDER DRY

In the *Flyoff* newsletter, issue #26, Al Abriss gives this advice to those of you who find your CA turning to a blob of jelly before you've had the chance to use it all: "While using some drugstore variety CA glue, I noticed a tablet of silica gel dessicant attached inside the cap. This seemed like a good idea, so now I store my Zap CA in a small ZipLoc bag with a packet of silica gel that came packed with a new camera. Using this storage method, a bottle of thin CA that's been in my flight box for the past seven months shows no sign of thickening."

Before you rush out and buy a new camera just to get the silica gel pack, visit either your local pharmacist or camera store—they usually have them to give away. And I also periodically take the silica gel capsules and put them in the oven under low heat to dry them out. An excellent tip, thanks to *Flyoff*.

INAV RETURNS

Indoor News and Views, the voice of the Indoor Model Airplane Society, has had a peripatetic existence during the last several years. For much of its life, *INAV* was the creation of Bud Tenny, and most recently Plenny Bates acted as the editor for a year or so before giving up the project. Now, according to my sources, the new *INAV* is being edited by a consortium of indoor types who promise regular delivery. The folks now in charge are Roy White, Larry Coslick, H. Henderson, M.J. Reilly and Bill Martin. If you want information on how to subscribe, or if you want to submit an article for publication, contact Roy White at 1025 Cedar St., Catawissa, MO 63015. ***MB***

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

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TECH STUFF *cont. from page 15*

were an infinite distance away.

For accuracy, the wind tunnel data needs to be corrected to the actual aspect ratio to be used if the airplane AR is not close to the AR used in the tunnel.

INDUCED DRAG

To swirl air requires energy, so the generation of the wingtip vortices increases the drag of the airplane. The component of the total drag which is due to the tip vortices is called *induced drag*.

Obviously, if a wing is very short, a higher percentage of the total air mass it travels through will be able to find its way around the tips. Therefore, induced drag increases with decreasing aspect ratio. Imagine a wing with an infinite aspect ratio; the wing goes on forever and there are no tips. With no tips there can be no tip vortices and therefore no induced drag. Frequent attempts have been made to reduce induced drag by special wingtip design or by the addition of tip plates, to try to reduce the tip vortices. With modern design some gains are possible, but those vortices won't completely go away.

The following are basic formulas relating induced drag to aspect ratio, lift coefficient and angle of attack. (My computer keyboard is deficient in math symbols, so these are word formulas.)

The induced angle of attack in degrees is equal to 18.24 times the lift coefficient divided by the aspect ratio. However, this is not the total angle of attack. The induced angle of attack is added to the angle of attack the wing would be at to develop that same lift coefficient if the aspect ratio was infinite. In other words, the total angle of attack is the angle of attack shown on a modern wind tunnel airfoil performance plot at a particular CL, plus the induced angle of attack.

The induced drag coefficient is the square of the lift coefficient divided by pi and divided by the aspect ratio. In a manner similar to finding the total angle of attack, the total wing drag coefficient is the induced drag coefficient plus the profile drag coefficient read from a wind tunnel plot. The profile drag coefficient of an airfoil section at a given angle of attack is also sometimes called the *section drag coefficient*. To get the total drag coefficient of the whole airplane, we add a *parasite drag coefficient* to the above two. Some aerodynamics books give parasite drag coefficient estimates for different types of airplanes.

Induced drag is sometimes called "the drag due to lift," but beware that both the profile drag and the induced drag increase with increasing the angle of attack.

In cruising or high-speed flight the induced drag is quite low, unless the aspect ratio of the wing is very low. At high angles of attack—i.e., during landing and takeoff—the induced drag is greater. Induced drag thus adds to our need for takeoff thrust, but helps reduce the landing distance.

With low aspect ratios the induced angle of attack is high at low speeds (high CL), therefore the total angle of attack is high. That's why the Space Shuttle, Concord and

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other delta-like configurations take off and land at very high angles of attack.

The induced drag coefficient is inversely proportional to the velocity squared, and directly proportional to the weight squared. This explains why a heavy airplane flying slowly is a stall or a snap roll waiting to happen. If the speed drops off a little the drag increases a lot (especially with a low aspect ratio). With that big increase in drag, the speed drops off a lot more, and it's crash city.

This very brief summary of basic aerodynamics omits a great many things. To learn more, read a good aerodynamics book or two.

GOOD BOOKS

In the past I've recommended *The Design of the Airplane,* by Darrol Stinton; *Aerodynamics of Model Aircraft Flight,* by Martin Simons; and *R/C Model Airplane Design,* by Andy Lennon. Now I have a fourth which I recommend: *Model Airplane Design and Performance for the Modeler,* by Howard L. Chevalier, who is a Professor Emeritus of Aerospace Engineering, Texas A&M University. All of these authors are modelers, and all know what they're talking about.

The 270-page book has a number of historical model and modeler photographs, and a great many sketches to illustrate the points the author is making. There are also curves and tables of engineering data. Most anyone who enjoys this column will get a lot out of Mr. Chevalier's book. You can order it from Challenge Engineering, Inc., P.O. Box 27, New Baden, TX 77870, for $27.90 postpaid. Phone 1-800-364-BOOK.

Another book I strongly recommend to the serious model designer is *Airfoils at Low Speeds,* by Michael Selig, John Donovan and David Fraser. This wind tunnel data book for over 60 different, mostly modern airfoils, each tested at several low Reynolds numbers, was discussed in more detail here in the August 1994 MD&TS column. This book also goes by the title *SOARTECH 8,* and is available for $20 postpaid from Herk Stokely, 1504 Horseshoe Circle, Virginia Beach, VA 23451; (804) 428-8064.

A final couple of books for your consideration are *Making Scale Model Airplanes Fly,* and *Vertical Tail Size for Models* by William McCombs. These are primarily free flight books. The first is available at $14.95 postpaid from McCombs at 2106 Siesta Dr., Dallas, TX 75224, and the second book is $2.95 with a two-stamp SASE. Or he will send you a summary of the books, *A Summary of Free Flight Model Troubles,* free for an SASE. ***MB***

WSJ *continued from page 51*

minute international precision duration format where the pilot declared the flight task after landing. A launching window was used, keeping the format man-on-man and truly competitive.

Wednesday saw nice weather with light winds for the standard class thermal competition. This event was run by the Moses Lake R/C Modelers, which is mainly a power flying club. Scoring was man-on-man; eight rounds were flown with constantly changing flight groups. The backup CD ran the event and accepted entrants right up to the start of flying even though the flight group matrices had already been run out of the computer. Clearly, their aim was to encourage participation and fun!

Cross-country saw a small contingent of teams take on a 22-mile course which ran from the sod farm and back. The Portland Area Soaring Society ran this event. Once good altitude was achieved in a thermal, the model crossed the course marker and the pilot and helpers made a run on the course. Unfortunately, thermal conditions never broke to produce more than mediocre lift and 3-mile flights. Interestingly, a scale ship made the longest flight of the day.

F3J followed on Friday and was run by

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All Full-Size plans purchased from MODEL BUILDER Magazine include a reprint of the construction article, if building instructions were part of the article.

No. 11941 TRAYS VITE **$12.00**
Don't be deceived by its rather conventional appearance; this unique little model, from the mind of innovative designer Roy Clough, is made almost entirely of foam deli trays! Can be powered with a Cox .020 or HiLine Imp electric motor for FF or rudder-only RC, or with an .049 for two-channel RC. Three sheets of computer-drawn plans and Roy's full-length construction text.

No. 8941 EX-29 **$12.00**
Proof positive that you don't have to spend big bucks to get real performance out of an electric-powered sport RC model, Al Clark designed this 40-inch span, 274 square inch low-winger for Kyosho's inexpensive AP-29 motor and five- or six-cell battery packs. Prototype features rudder/elevator controls and a simple electronic on-off switch for the motor.

No. 7941 FARMAN F-190/F-192 **$10.00**
Master free flight scale modeler Hurst Bowers turned out this nicely proportioned and great flying replica of a classic French high-wing cabin monoplane from the 1920s. Designed for the HiLine Mini 6 electric power system, the model spans 28-7/8 inches and is 21 inches long. Two different color schemes are detailed on the plan.

No. 7942 FARMAN F-190/F-192 **$12.50**
A 139 percent enlargement of Hurst Bowers' attractive electric powered FF Scale model (Plan No. 7941), intended for 1/2A RC Texaco Scale competition or just a fun two-channel "schoolyard scale" ship. Should fly quite well with a Cox Texaco .049. Span is 40-1/8 inches, full wing area is 318 square inches. Builders will have to determine wood sizes, beef up the structure in places and plan the radio installation.

No. 6841 MESSERSCHMITT M.17 **11.50**
An interesting model of Willy Messerschmitt's 1925 two-seater lightplane, designed by Van Hereford for the 1/2A Texaco Scale event. With its clean lines and high aspect ratio tapered wing, the M.17 looks like a powered glider and should be a strong competitor. Spans 58", 290 squares, all-wood construction, rudder/elevator controls, Cox reed-valve .049 engine.

No. 5941 AMBUSH 15 **$8.00**
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Jack Sile of England. Jack is one of the catalysts behind F3J, and is also a columnist for *Silent Flight*. The F3J format was a big winner with its hand-towing and man-on-man flying. The contest exposed a lot of American fliers to this FAI competition format, which is becoming increasingly popular in Europe.

Static scale judging was held Friday evening at the Tower Inn. The judging was done by three full-scale sailplane pilots and was broken into four classes: Vintage Precision Scale, Vintage Standoff Scale, Modern Precision Scale, and Modern Standoff Scale. The static points awarded were added to the flight points earned the following day. The same three pilots judged for launch, thermal turns, a figure eight, two optional maneuvers, the landing approach and landing. The judged flight was a warm-up for a thermal flight with time logged for each model. At the end of the day, each entrant received a North American Scale Soaring Association certificate.

Another celebrity speaker at WSJ was Professor Dr. Richard Eppler, who came from Germany and was present for most of the event. He gave two presentations; the first went back in history and covered longitudinal stability. He used slides and overheads to describe what longitudinal stability is, and demonstrated his points with a number of indoor free flight models he had built from historic model drawings.

Dr. Eppler's second presentation covered two-dimensional vortex flow, three-dimensional vortex flow, his theory of induced lift, lifting surface theory, and an explanation of how induced lift is produced. He let it be known that the modeling community can expect to see some new slope racing airfoils from him. After watching the races and the radical turns that were made, he explained that such tight maneuvers cause leading edge separation bubbles and that his new airfoils would be designed to avoid this. A remarkable man, Dr. Eppler's contribution to the WSJ was certainly one of the highlights.

The WSJ wound down Sunday with the F3B and power scale slope events. F3B was scheduled for the last two days, but the small number of entries compressed it to only one. The event ran through three rounds of thermal, distance and speed tasks, with each participant getting in nine flights for the day.

Power scale slope also ran on Sunday, but the wind didn't come up until after the CD called the event. By 3:00 p.m. the wind at Eagle Butte was moving and by 4:00 it was a strong 20 mph. The turnout for PSS was good, but many had already headed home before the wind came up.

The World Soaring Jamboree was a new and exciting format. The assortment of events featured everything from fun-flys to serious competition, a vendor forum, and outstanding speakers. With 208 entrants, The WSJ was one of the biggest RC soaring events of the year. The events were sufficiently spread out so that one could come for a few days and see a lot of different types of soaring.

It would be fabulous to see another WSJ. The modelers who made the trip and took part in a variety of events, even events with which they were unfamiliar, had by far the most stick time and most fun—which is exactly what the World Soaring Jamboree was all about! **MB**

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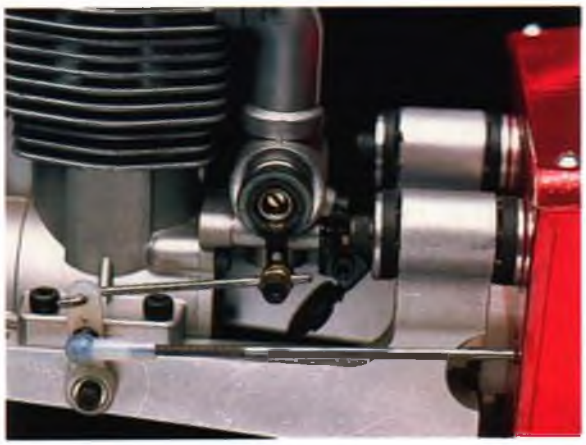

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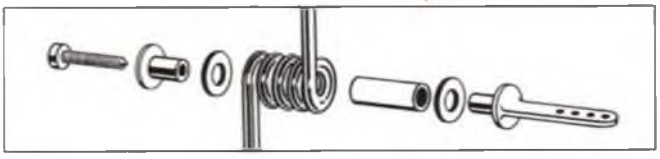

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