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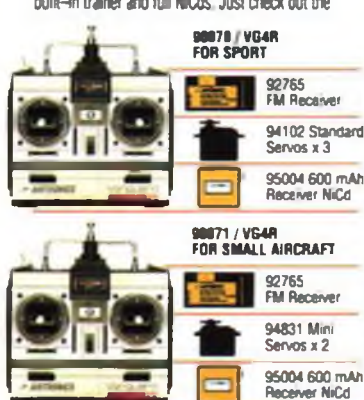
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ON THE COVER

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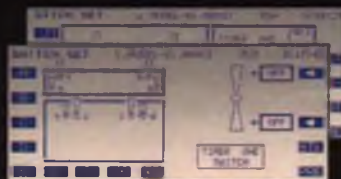
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9ZAP/S and 9ZHP/S systems include the R309DPS receiver and TK-FSS frequency module. Any of the fifty 72Mhz frequencies can be entered into the transmitter. Receiver rotary switches are set to the frequency number.

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T/A

T/R

PLANE TALK

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Demonstrating the creativity found throughout the radio control hobby, Austin Bailey produced the "Air Losi," which is the world's first and only known flying radio controlled off-road racing truck! Bailey, owner of Superior Hobby Supply in Champaign, Illinois, says the Air Losi is part RC airplane and part car—and has an RC helicopter tail boom. "The truck is made of parts from a Losi JRXT racing truck, a Sig Mid-Star 40 wing with enlarged ailerons and wingtip wheels for added ground handling, and a Kyosho Concept 30 tail boom. It uses a JR Max four-channel FM radio with dual Hobbico Command mini-servos for ailerons, and is powered by an O.S. Max .40 FP engine." Bailey flew its maiden flight last February at the Champaign Radio Control Club's field. "It flies like any sport plane, but when the power is cut it glides like a crowbar! Ground handling is nothing short of fantastic and the plane lands anywhere." Incredible! Austin Bailey, Superior Hobby Supply, 1706 W. Bradley Ave., Champaign, IL 61821.



Larry McDermott, of Taylorsville, Kentucky, scratch built this pair of Extra 300s from plans drawn by David Vaughn. "The red plane uses a YS 1.20 four-stroke engine, while the metallic teal ship uses an O.S. 1.08 two-stroke engine," he notes. "I built the header pipes on both Extra 300s. These 1/4-scale planes each weigh 15 pounds, span 72-1/4 inches and have a wing area of 885 square inches." Larry McDermott, 301 Deacon Trace, Taylorsville, KY 40071.



"After being out of the sport for a few years, I picked up the July '89 *Model Builder* and found this cute, 13-inch Pussycat," writes Kenneth Fraser of Redlands, California. "I built mine from scratch with a stick-and-tissue body and Styrofoam wing, stab and rudders. It also has a Slek Streak prop and landing gear, and Peck-Polymers prop shaft and bearing. I also added adjustable trim tabs with copper wire hinges." The heavy rains of early spring prevented Ken from flying his Pussycat at the time of submission, and we trust it flew well since. Kenneth Fraser, P.O. Box 7631, Redlands, CA 92375.

"Powerhouse Times Two" is the double-size version of Sal Taibi's 1938 Powerhouse, powered by a Saito 1.50 four-stroke. Owned by long-time modeler Larry Snedeker of Carmel, Indiana, it's the combined effort of Hank Hilscher (frame-up and hardware); Joe David (covered fuselage and installed pull/pull control system); Dick LaShure (covered wing);



Jeff Cooksey (covered stab and fin, and performed flight tests); and Chuck Kolby (installed engine, hooked up throttle, final balancing, etc.). "The model has a wingspan of 14 feet, overall length of 10 feet, wing chord of 26.5 inches and a total area of 30.9 square feet," says Snedeker, who was an early member of Tolerlo's Weak Signals Club and later helped Walt Schroeder in preparing the first WRAM Show in New York. "Flying weight is 31 pounds 14 ounces. The model required just under 4 pounds of lead in the nose to obtain the proper CG." The Powerhouse Times Two won 1st at the Hamilton Four-Stroke Rally in Cincinnati last September. Larry Snedeker, 19274 Briar Creek Lane, Carmel, IN 46033-4110.

AIRMAIL

Have a question or comment? Send it to Air Mail, c/o Model Builder, P.O. Box 669, Capistrano Beach, CA 92629.

OBVIOUSLY AN ELECTRIC FAN

I was not going to subscribe, but I noticed that you now have another writer for the Electric column. Good work! Please start my subscription with the June issue.

Herb Schaeffer
Rush, New York

MOGADISHU CALLING

I've been a regular reader for many years, but the last year or two pretty much gave up on *Model Builder*. I picked up an issue on the island of Diego Garcia—best in a long time.

I fly everything, but need *Model Builder* for control line and free flight. RC is everywhere.

Bob Schick
Mogadishu, Somalia

WHERE'S HIS SENSE OF HUMOR?

I would like to comment on a photo that you published in the April 1993 issue of *Model Builder*. The photo appears on page 27, at the bottom of the middle column. It is my opinion that you have shot the entire hobby in the foot with that photo.

I realize that it was probably a posed shot. But that photo published in a national magazine is going to convince a lot of people that RC modelers are *not* responsible people. They're just a bunch of irresponsible kids that look like adults. This is the exact opposite of what your magazine should be doing.

I have been in this hobby for many years. Many flying fields have been lost because the people flying the models were not responsible and did not act or fly their models in a responsible manner.

As far as [the author of that article] is concerned, whoever sells him liability insurance should cancel it. In addition, he should be banned from all flying fields for posing for such an irresponsible photo.

Richard Hodge
Coventry, Rhode Island

Editor Phil Bernhardt replies:

Oh brother, now I've heard everything. "Probably" a posed shot? Of course it was a posed shot! A blindfolded RC pilot, straddling a ladder and knife-edging a model through it—an utterly crazy, nonsensical, impossible stunt, just a bit of fun on the

photographer's part. I am surprised that someone who's been in this hobby for many years didn't see it as such.

Come on, my friend, lighten up. Even the most inexperienced modeler would instantly recognize that ridiculous stunt for the joke it was meant to be. I like to think that the average fellow browsing through a copy of MB at the newsstand would be intelligent enough to do likewise; I therefore wouldn't worry that our public image is going to suffer on account of that one photograph.

And, while there probably is a tiny percentage of the non-modeling public foolish enough and gullible enough to believe what they see in that photo, I wouldn't worry about them either. Those folks will never see it; they're too busy getting their truths out of the supermarket tabloids to pay any attention to *Model Builder*.

BETTER, EXCEPT...

Model Builder is getting better and better—except for the Dear Jake column. I think it's a waste. How about a full-size engine three-view of all current engines, one or more each issue, printed on thicker tear-out stock like business reply cards. I'm a loyal subscriber, have been for decades.

Larry Goldstein
Plainview, New York

What do you say, readers? Is this something you'd like to see?

HANDY HINTS

In past issues, we've asked for building tips and money-saving ideas from readers. Those printed, like the one below, will each win a custom *Model Builder* T-shirt. Send yours to *Model Builder* Tips, P.O. Box 669, Capistrano Beach, CA 92629.

Use the wire garbage bag ties that come with some brands of plastic garbage bags as "hinges" for your elevator or rudder tabs on free flight models. They work great and last a long time.

Bob De Rosier
Dallas, TX

P.S. I would appreciate tips or instruction on decorating a model with tissue paper after it's been covered. I have a helluva time cutting out numbers and letters in tissue paper, getting them on straight, designing the letters in the first place, etc.

You're in luck, Bob. Vic Cunnynggham Jr., an acknowledged master of the tissue trimming art, is currently hard at work on just the sort of article you're looking for. Watch for it in MB in the near future. **MB**

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ASTRO'S AC/DC PEAK CHARGER

As with its Model 110 and 112 DC chargers, Astro Flight's popular Model 111 AC/DC charger has also been upgraded to include peak detection circuitry. The new Model 111XL, as it's called, can charge from one to eight cells from household 110-volt AC, or up to 16 cells when using a 12-volt DC power source. Features include a DC ammeter, built-in DC/DC converter to eliminate false peaks caused by input voltage variation, a built-in cooling fan, and fuse and diode protection against polarity reversal. The unit is protected against short circuits and cannot be damaged by shorting the output connections.

The Model 111XL charger lists for \$159.50. Check it out at your local hobby shop. From Astro Flight, Inc., 13311 Beach Ave., Marina Del Rey, CA 90292; (310) 821-6242.

ACE'S ELECTRIC SEAPLANE

Scott Hartman's "Pondside" electric seaplane, published in the March '92 *Model Builder*, is now being offered as a kit in the form of Ace R/C's new "PuddleMaster." Other than a few minor construction details to make it easier to kit, the only changes Ace has made from the original is to move the tip floats out one rib bay and go to a built-up horizontal stab. We've heard nothing but favorable reports about how the airplane flies, even when powered by an inexpensive "can" motor. Recommended motors are the Great Planes Goldfire or Astro 05 cobalt swinging a 7x5 APC, or a Kyosho 360 ST with a 7x4 APC.



any of them running on six or seven cells.

The Puddlemaster spans 48 inches, covers 402 squares and shouldn't weigh more than 44 ounces ready to fly for best performance.

Ace recommends using mini or micro servos and a small battery pack or even a BEC setup for minimum weight. Suggested retail kit price is \$49.95.

From Ace R/C, 116 W. 19th St., Higginsville, MO 64037-0472; (816) 584-7121.

GREAT PLANES BRANCHES OUT

Having established its reputation as one of the premier RC kit manufacturers, Great Planes Model Manufacturing is now turning its attention to modeling tools, accessories and hardware, the result



being an impressively extensive product line that is sure to grow in time. Offered is almost anything you could need in the way of fasteners (screws, nuts, washers), landing gear hardware (wheels, collars, axles), control linkages (clevises, ball links, pushrods, hinges), engine and fuel system accessories (tanks, filters, NiCd starters, adjustable engine mounts, spinners), and a sizeable selection of tools. Many of the smaller hardware items—clevises and blind nuts, for example—are also packaged in bulk to save you money.

A free catalog of Great Planes kits is available by calling (800) 682-8948, ext. 93AC; if you ask, they'll probably also include one of the consumer brochures describing the new hardware line.

MIDWEST'S AT-6

One of the new kit releases that attracted the

most attention at Toledo this year was the very nice large scale AT-6 Texan from Midwest Products. Actually, the kit is due for release later this summer; what was shown at Toledo was one of the prototypes built by designer Tom Herr. The all-wood model spans 81 inches, making it eligible for IMAA events, and is designed for .90-1.08 two-



strokes or 1.20-1.50 four-strokes.

Midwest has been working closely with Robart Mfg., who is developing a retractable landing gear especially for this model, and wants to hold off releasing the kit until the gear is ready. We'll have price and availability info for you in this column as soon as we can. Stay tuned!

HITEC + RCD

We received notice that Hitec R/C USA Inc. and RCD Inc. have merged, the

new company now being known as Hitec RCD Inc. At the same time, the company has moved to a new facility, located at 10729 Wheatlands Ave., Suite C, Santee, CA 92071. The new phone number is (619) 258-4940. FAX number is (619) 449-1002.

SUPER ELECTRONIC SPEED CONTROL

Jomar's new "Maxcell" microprocessor-controlled throttle for large electric power systems can handle from 12 to 40 cells at a continuous current of 40 amps. Features include a 5 kHz chop rate for high efficiency, optical isolation, 100-volt MOSFET power transistors, brake, soft start, signal filtering, safety shutdown, and one-button computer setup. The unit



weighs 1.8 ounces, comes mounted to an aluminum heat-sink plate as shown, and includes a Futaba J-series connector. Going price is \$149. Available at selected electric flight dealers across the U.S. or direct from Jomar Products Corp. at their new address: 3440 Riverhills Dr., Cincinnati, OH 45244. You can also get answers to questions direct from company owner Joe Utasi by calling (513) 271-3903.

FLY ELECTRIC WITH A VENGEANCE

The new Vengeance electric motorglider from Davey Systems is now being shipped; we have one being built right now for an upcoming Products In Use review article. The model is a versatile design for seven- to 12-cell systems and is offered in four different versions: 1) Basic kit; 2) The kit plus a "Hyperthrust II" 075 motor,



fused switch harness, prop adapter and non-folding 8x4 glass prop; 3) Same as above but with a Sonic-Tronics 8x4 folding prop and Master Aircrew spinner; and 4) Same as above but with a Master Aircrew 12x8 folding prop, spinner and 3:1 gearbox.

The Vengeance is an all-wood two-meter ship sporting a 635 square inch wing with a turbulated S3021 airfoil. The plans and instructions detail the installation of 05, 075 and 15 motors, direct and geared, as well as the larger 700 series motors such as the Graupner Speed 700 Turbo.

From Davey Systems Corp., 675 Tower Lane, West Chester, PA 19380; (215) 430-8645.

THE IMMORTAL SE5A

Proctor Enterprises is now



handling a couple of exceptionally nice scale kits produced in England by world-class scale competitor Duncan Hutson. One of them is the SE5A pictured here, which spans 73 inches, weighs in at 14 pounds and is ideally suited to a 1.20 four-stroke. The \$374.95 kit comes with a highly detailed fiberglass fuselage topdecking extending from the nose to just past the cockpit, die-cut ribs and fuselage formers, pre-bent cabanes, scale wheels and Vickers gun, roundel decals, a complete set of flat rigging wires and fittings, two sheets of plans, and complete building instructions. For more details, contact Proctor Enterprises, 25450 N.E. Eilers Rd., Aurora, OR 97002; (503) 678-1300.

BALL BEARINGS GALORE

Anything you could possibly need in the way of ball bearings for your model

airplane or helicopter engine is listed in the new updated Engine Bearing Guide just released by Boca Bearing. Both U.S. standard and metric sizes are covered. For your copy, send \$3.00 to Boca Bearing, 7040 W. Palmetto Park Rd., Suite 2304, Boca Raton, FL 33433.



DYNAFLITE'S LATEST

Another large scale warbird coming on the market is Dynaflite's

new 81-inch span Spitfire, a balsa/plywood kit featuring the same type of simple construction used in their smaller .40-size Spitfire. The new model was

displayed at Toledo with a sign inviting passersby to pick it up, and all who did so couldn't help but marvel at its exceptionally light weight. That ship had fixed gear, but even with retracts aboard (the plans detail a retract installation) the wing loading would be no higher than what you'd expect to see on the average RC trainer. The kit retails for \$199.95 and is produced by Dynaflite, P.O. Box 1011, San Marcos, CA 92079.



CALL A TAXI!

Graupner's Elektro-Taxi is an all-balsa RC sport electric model with a cabin-type fuselage, wide-track taildragger landing gear and a one-piece, bolt-on wing. An unusual feature is that the battery pack can be easily removed and installed through the removable windshield without having to take off the wing. Hobby Lobby handles the Elektro-Taxi kit here in the U.S. and describes it in detail in the new Catalog 22, available free for the asking.

Offered as a complement

to the kit is Graupner's Speed 600 Eco power system, consisting of a Speed 600 motor, 8x4 Slim prop, spinner and noise suppression capacitor. Hobby Lobby recommends running it on a seven-cell, 1700-mAH pack (also available) for the best compromise between power and duration.

To get your free catalog, write or

call Hobby Lobby, 5614 Franklin Pike Circle, Brentwood, TN 37027; (615) 373-1444.



AN AFFORDABLE COMPUTER RADIO

Also unveiled at Toledo was

Airtronics' new Quasar six-channel FM computer radio, a relatively inexpensive (about \$500) system aimed at the sport flier market. It doesn't have all of the high-tech bells and whistles of the more costly computer systems, but let's face it, most of those bells and whistles are of little use to the sport RC flier. The Quasar instead focuses on the basic, important stuff.

One of the most important features of the Quasar is its ease of programming. The

transmitter has a large, easily read LCD screen at the bottom, and all of the inputs are done with five buttons. The programming has been simplified to the point where it's pretty much self-explanatory—you almost don't need the instruction booklet.

The Quasar is offered in both airplane and helicopter versions, and there are a number of special features exclusive to both. Your best bet is to contact Airtronics directly to get full particulars. Write to Airtronics, Inc., 11 Autry, Irvine, CA 92718, or call (714) 830-8769. **MB**



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

DEAR JAKE

Advice For The Propworn

DEAR JAKE:

I was amazed to see that a working example of the Zero Displacement Engine still exists (April 1993 issue). But you missed some of the most important features! It will turn any size prop you can bolt on it, without lugging, and the larger and heavier the prop, the longer it runs. You can literally choose a prop size for scale effect without worry.

Also, the engine could compete in any current class; alcohol, diesel, or gas. Carrying the correct fuel (in a sealed tank) is only required for qualifying and no fuel line is needed, as you found out. And no firewall is needed either, since there's no risk of fire. Note that no engine backplate is required, so you can carefully hook some rubber bands to the back of the crankshaft and compete in the rubber class. Electric can be set up the same way. An idiosyncrasy when used in the rubber class is that the engine must first be spun backwards to get it started. . . no big deal.

It is correct that the head could be removed without loss of power, but Contest Directors never approved this as a proper engine, except in the rubber and electric classes, where the head should be removed to avoid arguments.

Unfortunately, these engines are now illegal to own, since a major engine manufacturer together with a major fuel company bought up all rights and have strictly forbidden any further use. I wish I could say more about this matter, but I'm afraid I can't. Even publishing a picture as you did is very risky!

Gordon in Tabernacle, NJ

Dear Gordon:

You may be right about using the Zero Displacement Engine as a bearing block for a rubber-driven propeller, but I have continued my original evaluation (which I reported on in haste before it was complete) and I have concluded that the ZDE is quite worthless as a substitute for a regular gas engine.

Weight is a very serious problem. Do you realize that the weight per cubic inch of the Zero Displacement Engine is infinite?! And I was stupid enough to recommend the ZDE for multi-engine airplanes. Put two of them on a model and the weight per cubic inch balloons to twice infinity!

And what about cooling? Did you notice that there are no fins on the ZDE's cylinder housing? How is it going to run cool when there are no fins to dissipate the heat?

Worst of all, the propwash from the ZDE doesn't contain any oil droplets. That means no oil washing back over your airplane to lubricate the hinges or the wheel axles, and no oil residue to keep the silk and dope from drying up and cracking.

What finally turned me completely sour

on the Zero Displacement Engine was the woeful performance of the Zero Wing Area monoplane I built for it. The glide was brick-like and it did not improve at all with the engine running. Wind tunnel test results showed very poor lift-to-drag and thrust-to-weight ratios. I assume the poor L/D was due to high drag rather than low lift, although I can't account for the drag increase, and I'm certain the lousy thrust-to-weight was due to that infinity problem.

By the way, I must dispute your claim about being able to put any size prop on the Zero Displacement Engine. I tried a 24x10, and the little prop screw that comes with the ZDE wasn't thick enough or long enough to do any good whatsoever with the 3/8-inch diameter hole through that 1-1/2 inch thick propeller.

Jake

DEAR JAKE:

I've discovered a new covering material for model airplanes: Post-it Notes. They come in all different sizes, colors and patterns, and they're real easy to apply. You stick the sticky part to the leading edge and glue the unsticky part to the ribs and spars. On a fuselage, you start at the back and work your way forward, overlapping the unsticky parts with the sticky parts and making sure that all seams face aft (downwind).

On a rubber-powered or a towline model, it's ready to fly. On a gas model, you can fuel-proof with dope or epoxy. And the Post-its are perfect for trim and numbers. Just cut out whatever numbers or designs you want from the sticky part of a contrasting color pad and stick 'em on.

This idea is so great, I should probably patent it. What do you think?

Innovator in Inscoc, IA

Dear Innovator:

I have a 3x5-inch Post-it pad here on my desk. It has 100 sheets and weighs about 4 ounces. By my calculations, and taking into account overlap and trim requirements, a typical airplane of approximately 800 square inches would require about 12 of these pads to cover the wing, tail, vertical fin and fuselage. That's 3 pounds of covering, not counting the dope or epoxy to seal it or the glue to attach the "unsticky parts," as you put it.

Given the weight penalty and the subsequent unlikelihood of anything covered with it being able to fly, I think that if you bring this product out for model airplane use, you should rename it. "Plant-it" comes to mind, or perhaps "Pile-it" is more in keeping with an aviation theme.

Jake MB



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THE PURSUIT OF PERFECTION

The subject this month is flight trimming, with emphasis on how you can avoid much frustration on the flight line by spending some extra setup time on the workbench.

Perfection is a familiar subject for pattern pilots. Precision is what the sport is all about. Lovely, balanced, symmetrical maneuvers fluidly traced on the great blue dome of sky, with (hopefully!) nary a bounce or bobble to be seen. Pattern dreams are composed of flights that look as if they were machined on a CNC lathe to CAD-generated specifications. We aspire to perfect circles and radii, exact angles, and impossibly straight lines.

In hot pursuit of these geometric ideals, we have to compensate for all the obstacles that chaotic Nature can toss at us; wind at odd angles and varying speeds, humidity, thermal activity, varying degrees of visibility, and extremes of temperature. On the average day, it's not easy up there, trying to

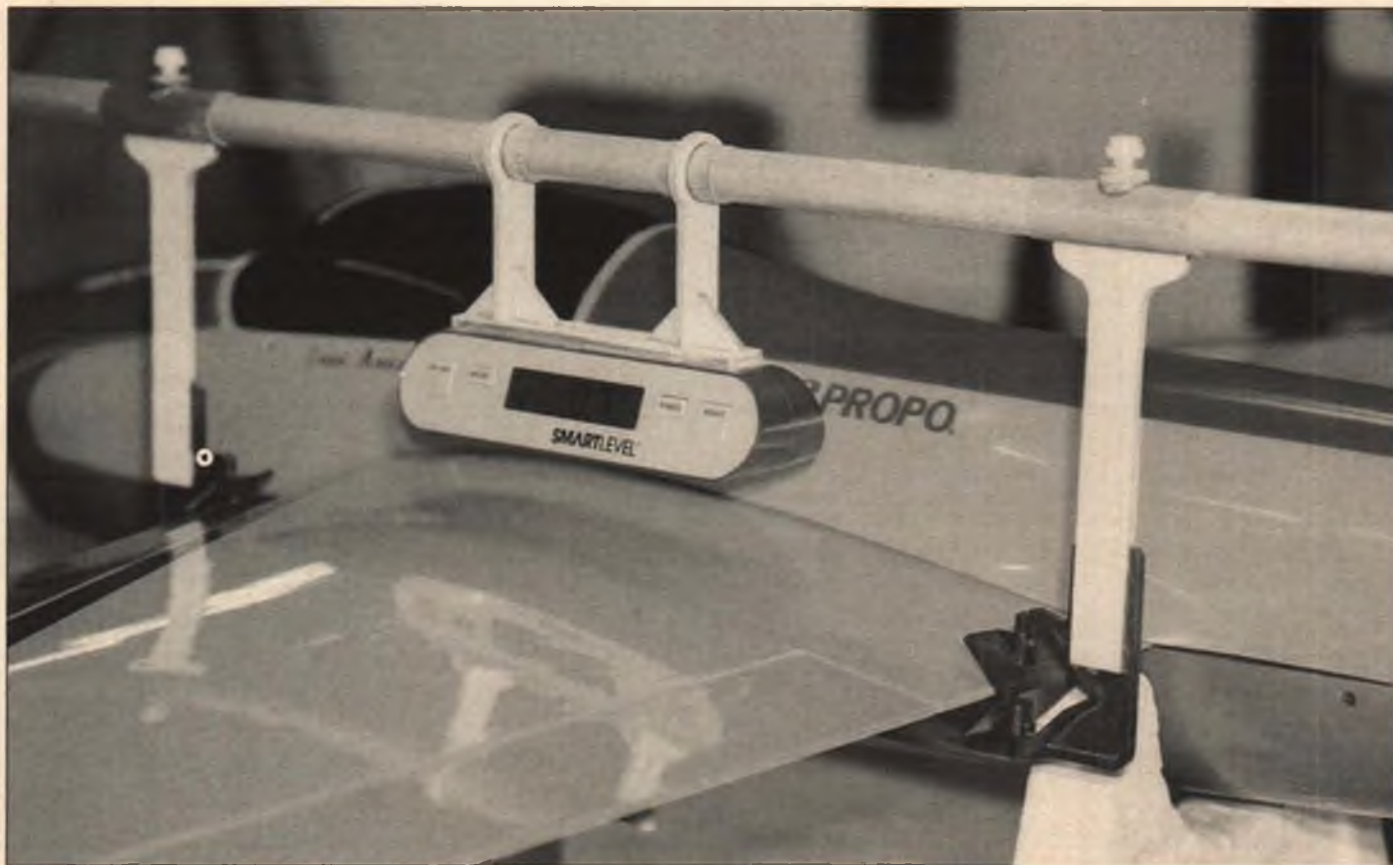
carve beauty out of raw air. Making good geometry is hard work. To do good work, you need good tools. To a pattern pilot, a good tool is a well set up, well-trimmed airplane. You need all the help you can get. The airplane should fly itself as much as possible, so you can concentrate on flying the maneuvers.

Trimming is regarded by many pattern novices as something akin to the Lost Secrets of the Incas, or perhaps the Mysteries of the Pyramids. This simply isn't true. Trimming is nothing but codified common sense. Nowadays, it's easier than it's ever been. Thanks to the mixing functions built into our computer radios, we have more wrenches in the trimming toolbox. Years ago, sometimes even minor adjustments

called for razor saws, shims and epoxy. With mixing, small birth defects (and even some minor inherent design problems) can be dialed out. The trick today is knowing what to fix, what to mix, and where to start.

Most people look at trimming as primarily a flightline activity, which probably explains why they expect it to be a frustrating and lengthy process. Good trimming technique starts in the shop, very early in the building process. Straight airplanes are easier to trim (I told you this was common sense!). The best trimming tip I know of calls for *not* building in warps and incidence problems.

Most plans call out the proper mainplane and tailplane rigging angles and the engine thrust offsets. The right thrustline offsets are



The author's homemade incidence meter, the heart of which is the SmartLevel digital inclinometer. Excellent accuracy and repeatability.

very often molded into the fuselage spinner ring. These called-for settings may not be where you end up once the ship is trimmed, but they will be close, and they are definitely where you want to start. A good incidence meter can save much frustration. I use a home-brewed device made from an aluminum wing tube, pieces of old commercial incidence meters, and an excellent digital inclinometer called a SmartLevel, made by Wedge Innovations of Sunnyvale, California. It reads an accurate, repeatable 1/10 degree. Most home centers and hardware stores carry this item.

When rigging the main airframe components during the assembly process, take all reasonable care to insure that the final product will be square. All of the trammeling measurements should be plus or minus 1/16 inch at most. I've always felt that plus or minus less than I could see was just about good enough. Make certain that the stab is not tilted relative to the wing. If the mainplane and tailplane aren't mounted in parallel planes, you will have big trouble trimming your plane. That's plain, isn't it?

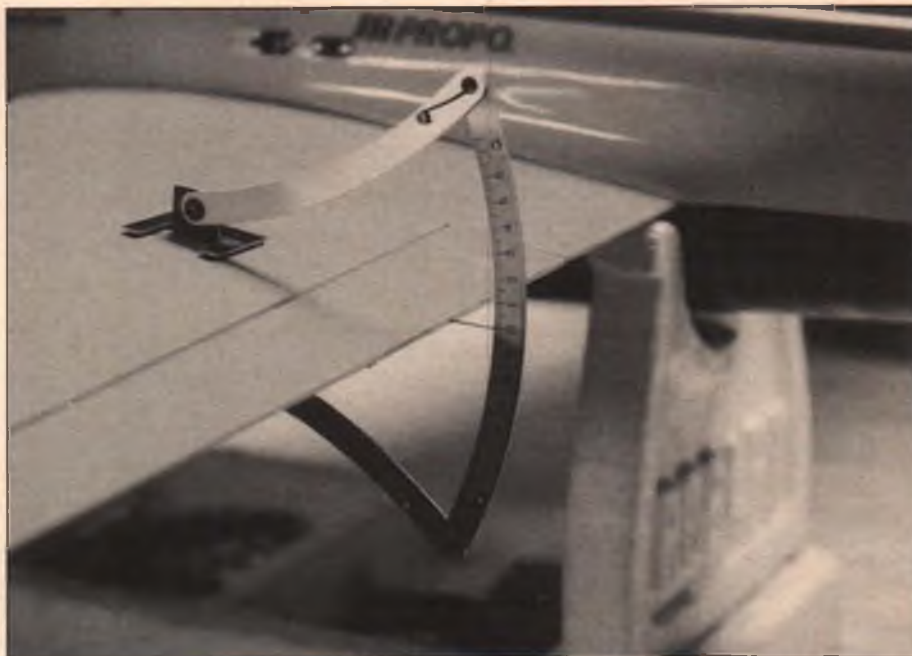
Radio installation and setup can make the flightline portion of the trimming process either very easy or nightmarish, depending on the quality of the work you do. Geometric precision in the air begins with geometric precision on the workbench.

If you opt for "easy," start by making sure that both of your control horn pivot points (clevis holes) on paired surfaces (ailerons and elevators) are the same height from the surface and the same distance from the hinge line. Bend or move the horns to achieve this if you have to. Directly over the hinge line is the best spot for a pivot point; anything else builds in mechanical differential.

When installing paired servos, as is typical on ailerons, measure the angle from the servo output shaft to the pushrod attachment on the servo arm or wheel, and make sure it is very close to 90 degrees to the direction of pushrod travel, and the same on both servos. Again, anything else means you are building mechanical differential into the linkage. Some modern computer radios provide a feature whereby the servo center points may be individually adjusted electronically. If you have such a convenient feature, by all means use it. It was intended for just this purpose.

Use a good surface deflection indicator to set control surface travel on the bench. Tetra makes a very good, accurate, easy-to-use unit. I like to make provision for a pointer on each control surface by inserting a small diameter brass tube into the surface edge. A short piece of wire can then be plugged into the tube for an accurate and repeatable reading.

Set the initial aileron deflections without using electronic differential, and make mechanical linkage adjustments to achieve equal deflection, both up and down, on both ailerons. Set the travel limits with the servo travel adjustment feature only after



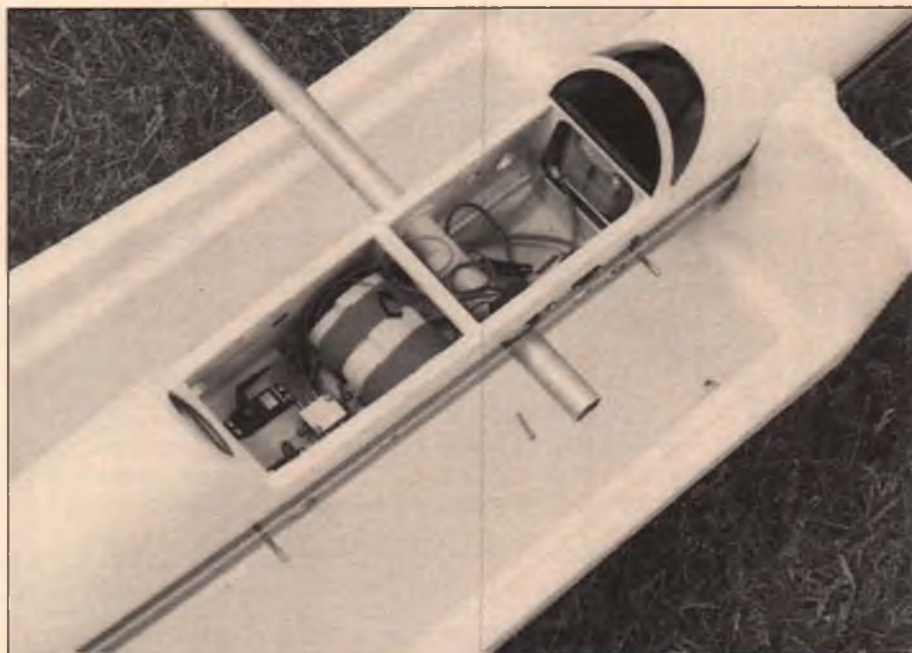
The Tetra Surface Deflection Indicator. The pointer is a piece of wire inserted into a small brass tube built into the aileron trailing edge. Easy, accurate, and fast.

adjusting for equal deflection. The idea is to set things up so that when you have zero differential dialed into the radio, you actually have zero differential on the airplane. For the settings on the radio to make sense, you must start from an accurate zero!

The same idea holds true for elevators. Both halves must deflect and center exactly the same. Adjust the linkages mechanically

you into the ballpark on most designs. Anything past about 15 degrees of travel is adding more drag than control surface effectiveness.

The initial dual rate settings can be made at this point, along with whatever amount of exponential you like. I like to start at 75 percent on dual rates. All this does is give me a "comfort zone" setting to switch to



A clean and neat radio installation in Bob Crump's Typhoon. Work like this in the shop pays dividends at the field.

until they do. If you are using separate servos for the elevator halves, then all the rules for aileron setup apply as well.

Set the travel as called for on the plans. If your plans lack travel settings, 11 to 12 degrees up and down on ailerons and 15 degrees up and down on elevator will get

during the initial test flight if things feel a little too quick up there. I use 25 percent for a beginning value on expo. This is just about enough to overcome the rotary servo wheel motion and give me a linear output at the surface.

Rates and expo or VTR settings are very

personal "like/dislike" items, and have everything to do with tailoring aircraft "feel" to the pilot's personal taste. Both travel rates and expo interact with control stick length; the shorter the stick (or the nearer to the gimbal pivot point the stick is held for those who fly with thumb and forefinger), the faster the response. Stick length should be set first, according to the pilot's flying style (thumb or pinch, tray or no tray) and physical hand size, and then the rates and expo used to tailor the aircraft response during flightline trimming.

The last important trimming step in the shop is to properly balance the aircraft. Again, whatever is shown on the plans is a good place to start. If nothing is shown, call the designer. Don't worry about bothering him; he deserves to be bothered for overlooking something that important. If you can't find him, about 35 percent of the MAC (mean aerodynamic chord) is the sweet spot for most modern pattern airfoils. Some of the NACA laminar flow foils currently gaining popularity will tolerate locations as far back as their high points, at 40 percent of the chord or more, depending on tail volume.

To find the MAC, add the tip chord to the root chord and the root chord to the tip chord and draw intersecting lines from the top of the new root to the bottom of the new tip and vice versa. Draw a chord line parallel to the root chord through the intersect point. This is the MAC. Convert your chosen percentage to a linear measurement and measure it off from the leading edge back. The aircraft should balance on a line drawn through that point perpendicular to the root chord or wing centerline. If it doesn't, move the battery pack, add lead, put the engine on a low fat diet (just kidding!), or do whatever it takes.

I also recommend balancing the airplane

laterally. This you can do by suspending the bird from the prop shaft and rudderpost or tailwheel bracket. The lead goes on the light side. I do this before finishing. Actually, I do it during building, by weighing each wing and stab panel as they are made.

Sealing hinge gaps is very important. Not only does it increase control surface effectiveness, it is the only way I know of making sure that both wing surfaces will provide equal lift and all control surfaces will show a predictable linear response throughout the deflection range. I can almost unconditionally guarantee loop tracking problems if this is not done. Those who don't seal

Trimming is nothing but codified common sense. The trick today is knowing what to fix, what to mix, and where to start.

gaps and get away with it are glorious examples of dumb luck in action.

The final item before leaving the shop for the flying field with a new ship is to completely assemble the aircraft and run a final checklist for correct direction and travel on all surfaces, proper fuel hookups, throttle travel and direction, retract operation, and tightness (no binding!) on all control linkages. This cuts down considerably on overlooked minor details, like ailerons hooked up backwards.

At the field, set the bird up and check everything again before you taxi out. It's a good idea to make sure that you've got a properly operating powerplant and (most important) a reliable idle. Engine problems

on test flights bury at least as many new ships as dumb thumbs do.

In the air, start the flight trim process by dialing up straight and level on the transmitter trims. If you've done your homework right, you won't need to move things too far. Do some vertical pulls into the wind to check for thrust offset. Make sure that the wings are level as you do this. No airplane goes up straight from a bank. Trim the rudder as necessary for a straight vertical.

Next, check the balance point. There are several ways to do this. You can pull into a slight climb, roll to 45 degrees of bank and release the controls. A properly balanced aircraft will hold the attitude as the nose drops slowly. A tail-heavy ship will not drop the nose much and may not hold the attitude well, and a nose-heavy ship will head for terra firma like a homesick shotput. If you suspect at this point that you have a balance problem (or even if you don't), turn the sucker upside down. A well-balanced machine will take just a bit of forward pressure to hold inverted; a tail-heavy machine may take none or even climb, and a nose-heavy bird will need a bunch.

Next, fly some power-off vertical downlines. The airplane should drop straight for at least 100 meters. A tail-heavy ship will tuck under (pitch to the belly), and a nose-heavy bird will pull out (pitch to the canopy). This is simply because you have set the tailplane (elevator trim) to hold straight and level flight, and that setting is loading the mainplane (wing) in the dive, causing a tuck or pull. Nose-heavy ships need up trim to fly level, and tail-heavy ships need down trim, right? Make sure you are pushing to full 90 degree downlines as you do this. When you are satisfied that you know for certain how the ship is behaving on this test, land. It's time to make adjustments before proceeding.

You should now know beyond reasonable doubt which direction the balance point needs to move—if it needs to move at all. You should also know if the thrustline offset needs tweaking. This is plenty for a first flight. Since everything you do from this point interacts with both thrust and balance, and since these items are difficult or impossible to deal with using mixing, you fix.

Not mix; fix.

If you needed right rudder trim to hold the verticals, shim for more right thrust. If you needed left trim, you have too much right thrust, so shim some out. Make the adjustments in small increments and fly the plane until you are satisfied.

Add lead or move components to adjust the balance point until the power-off downlines are straight for at least 100 meters (beyond 100 meters, almost any ship will drift toward the canopy slightly). Check yourself by flying upside down or doing the 45 degree bank routine. When you are happy, it's time to deal with vertical uplines again. That's where we'll start next month, because I'm out of space. **MB**

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6. Occupation of head of household: Student ☐ Professional ☐ Sales ☐
Service ☐ Laborer ☐ Other _____
7. Head of Household Income: Under \$15,000 ☐ \$15,000-\$24,000 ☐
\$25,000-\$34,000 ☐ \$35,000-\$49,000 ☐ \$50,000-\$74,000 ☐
\$75,000-\$100,00 ☐ Over \$100,000 ☐
8. In which model are you interested? If more than one, indicate preferences in numerical order, 1 - 4:
FF _____ RC _____ CL _____ Static _____
9. In which categories are you currently active? RC ☐ FF ☐ CL ☐ Static ☐
10. How long have you been active in your categories?

	RC	FF	CL	STATIC
Less than year	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1-2 years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2-5 years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5-10 years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Over 10 years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Do you build your own models (not including ARFs)?
All ☐ Most ☐ A few ☐ None ☐
12. Do you design and build from scratch? All ☐ Most ☐ A few ☐ None ☐
13. Do you scratch-build from plans? All ☐ Most ☐ A few ☐ None ☐
14. Do you build from kits? All ☐ Most ☐ A few ☐ None ☐
15. Do you assemble and fly ARFs? All ☐ Most ☐ A few ☐ None ☐
16. How many model aircraft have you built since you began in the hobby?
RC _____ FF _____ CL _____ Static _____
17. If you build and fly RC, what types? Sport ☐ Scale ☐ Pattern ☐
Helicopter ☐ Glider ☐ Pylon ☐ Old Timer ☐ Other _____
18. If you build and fly FF, what types? Sport ☐ Scale ☐ Pattern ☐
Helicopter ☐ Glider ☐ Pylon ☐ Old Timer ☐ Other _____
19. If you build and fly CL, what types? Sport ☐ Scale ☐ Pattern ☐
Helicopter ☐ Glider ☐ Pylon ☐ Old Timer ☐ Other _____
20. How many model aircraft do you have that are entirely or nearly flyable?
RC _____ FF _____ CL _____
21. How many radio control systems do you own? _____
22. How often do you fly? _____ days per week _____ days per month.
23. How many hours a week do you spend on your model aircraft hobby? _____
24. To what model aircraft organizations do you belong? Include National, regional, local (club), special interest (initials such as AMA, SFA are ok) _____
25. Do you plan on joining any organizations this year? Yes ☐ No ☐
26. If so, which ones? _____
27. In what organized model flying activities do you participate?
Competition ☐ Fun-Flys ☐ Both ☐ Clubs ☐ None ☐
28. If competition, at what levels? Club ☐ Local ☐ Regional ☐
National ☐ International ☐
29. Are you a subscriber to Model Builder? Yes ☐ No ☐
30. How long have you been a subscriber? _____ years
31. If not a subscriber, how many copies of Model Builder do you buy a year? _____
32. Where do you obtain your copies of Model Builder? Subscription ☐
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33. How many hours do you spend reading an issue of Model Builder? _____
34. How many friends also read your copy of Model Builder? _____

35. Do you save back issues of Model Builder?
Yes ☐ No ☐

36. If so, how far back? _____ years.

37. How often do you refer to a back issue? Weekly ☐ Monthly ☐ Yearly ☐

38. What other hobby magazines do you read? Flying Models ☐
Model Airplane News ☐ Model Aviation ☐ Radio Control Modeler ☐
RC Report ☐ Other _____

39. Model Builder is . . . Better Than: Same As: Not As Good As:

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Model Airplane News	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Model Aviation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Radio Control Modeler	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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Scale RC Modeler	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

40. What percentage of advertising in an issue do you read in its entirety? _____ %

41. What influences your decision on what to buy for your model aircraft hobby? Advertising ☐ Articles ☐ Fellow modelers ☐

42. Does the information in Model Builder help your decision on what products to buy? Yes ☐ No ☐

43. How much money do you spend on your hobby each year? _____

44. What major RC related products do you plan on purchasing this year?

45. Where do you purchase most of your model aircraft supplies?

	Most	Some	Very Little
Hobby Shop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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Mail Order Discount	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

46. Do you own a personal computer? Yes ☐ No ☐ Brand _____

47. Model Builder wants to know which of its regular columns and features you like or dislike.

	Like	OK	Don't Like
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Dear Jake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Electronics Corner	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Electric Power	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Free Flight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hannan's Hangar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helicopter World	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inside Engines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Model Design & Tech Stuff	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Over the Counter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plane Talk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plug Sparks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Precision Aerobatics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RC Pylon	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Products in Use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RC Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FF Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CL Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peanut Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

48. What would you like to see in Model Builder in addition to the present content? _____

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CONTACT!

Ever wonder how the experts get their engines started with just one or two flips? Here are some valuable hints to help novice CL fliers gain experience with model aircraft engines.

It's a big contest.

A crowd of spectators lines the combat field as the teams listen to the countdown. The pilots stand ready with handles firmly gripped. The pit crews wait, the starters gazing thoughtfully at the carefully aligned props while the helpers grip the planes, ready for quick release.

"Ten seconds. . . five seconds. . . GO!"

Each starter smartly strikes the prop, two engines roar to life and the helpers immediately release. Within two or three seconds of the signal, both planes are circling the field, pilots craning their necks to see their

three Fox Stunt .35s snarl to life and tow Ringmasters, Shoestrings and Busters aloft to begin the local sport race.

All around the contest field, competitors reach the moment of truth—when the engine must start on demand. And so it does, in only one or two flips. On the sidelines at each circle, undoubtedly a novice flier is wondering, *How do they do it?*

There's no substitute for experience, but with practice the novice can learn the experts' standard techniques and get those one-flip starts.

The operation of single-cylinder two-

cubic inch displacement. This month we'll discuss starting one of these larger glow engines and will assume that it is not muffled. A muffler requires some special handling, which we'll discuss later.

Each brand and model of engine is slightly different in the way it needs to be handled and the way it sends signals to the flier about its needs. The only way to learn a particular engine's language is to work with it.

The first piece of advice a novice should take to heart is to avoid the use of an electric starter. It will slow the process of learning how to properly operate your engine, and could even damage the engine if used by an inexperienced individual. There are very few engines used by control line fliers that require any artificial starting aids. About the only exceptions are the high-level competition speed engines, which a novice won't be dealing with.

It is, however, a good idea to get a stout glove, or better yet, a leather thong to protect your fingers. I advise against using a "chicken stick" because I believe it is unsafe to strike props with hard objects, even when covered with a soft material such as a length of hose. At the least, the hard stick can break props. And, once again, the "feel" is lost.

If the engine you are about to start working with is brand new, bear in mind that many engines are harder to start the first time or two; after only a few starts they will start much more readily as the break-in proceeds.

When making your first start, you won't know where the needle valve is set, so you'll be guessing at the fuel mixture. Using the manufacturer's instructions, open the needle valve a bit more than probably is necessary. We want to start off with a rich run.

Make sure the engine is drawing fuel. Choke the engine by covering the venturi and turn the prop over a couple of times while watching the clear fuel tubing; you should see some fuel moving through the line. Flipping the prop smartly (without the battery connected) after choking should result in the engine loosening up—the prop should snap back and forth after being flipped. If it hasn't loosened up yet, an exhaust prime should do the trick.

The old-fashioned way of exhaust prim-



Utah's Gordon Delaney builds some beautiful airplanes, as exemplified by this profile stunter seen at the 1992 Northwest Regional CL Championships. Power is an O.S. .40 FP. Jim Cameron photo.

opponent's streamer.

Across the field at the precision aerobatics circle, an expert class flier kneels and flips the propeller once. Instantly, the growl of the finely tuned .40 swells. The competitor wipes his hands, removes the battery, neatly stows the pit box and accessories off the side of the circle, strolls to the center, picks up his handle, dons the safety thong, pulls the lines tight, hesitates a second, and waves for launch. The huge stunter rolls away from the pit with 25 seconds left in the one-minute starting period.

At the racing circle, three teams listen to the final seconds of a countdown. On "GO,"

stroke engines is as simple as their design. Learning to operate them is simply a matter of learning to understand the engine's language. That's the right term, because an engine definitely will "talk" to its owner. Understanding what it's saying is the key to starting and operating the engine. The language of the engine involves the sounds it makes when running or being started, as well as its physical reactions to the owner's ministrations, such as the "bump" that reveals the engine's readiness to fire.

The engines that speak most clearly are those sizes considered to be the standard for control line planes—.19 through .65

ing was to just squirt some fuel into the exhaust, often with the exhaust pointing down at the ground so we couldn't see what we were doing. Nowadays the accepted practice is to turn the model so that the engine exhaust faces up. Close the exhaust port and just fill one corner of the exhaust with fuel. Open the port and let the fuel run in. Set the plane upright. We now have added a measured amount of fuel to the combustion chamber. This should be plenty to get the engine to fire. A couple more flips of the prop should indicate that all is loosened up.

Warning: *Do not prime an engine with the battery connected!* It's an invitation to a flash fire, which always is an annoyance and could result in damage to your plane or you.

After the prime, attach the battery. Grasp the prop and hold it while attaching the battery clip, because well-fitted engines have been known to start spontaneously. Slowly turn the engine over counterclockwise, holding the prop blade firmly as you do so. As you turn the engine over, you may feel the prop jerk backwards against your hand. This is the "bump" that indicates we've got just about the right amount of fuel in the engine for a prime. If it is a strong bump, the engine is well-primed, possibly close to being over-primed (which shouldn't be a problem with a cold engine). If the bump is weak, it is a little under-primed but still probably ready to start.

If there is no bump, the engine is either dry or flooded. Turning it over a few times may bring a bump. If there's a lot of fuel visible—maybe dripping out of the exhaust—and the engine suddenly bumps strongly, it's flooded; don't add more fuel! If more choking brings about a bump, the engine was dry and the bump indicates that the engine is now ready to go.

To actually start the engine, tradition suggests flipping the prop counterclockwise. However, this may not be the appropriate action for the circumstances—it depends on what your engine "says."

Try flipping the prop smartly forward, or counterclockwise, through the compression stroke. If the engine is heavily primed, it may kick violently but fail to start. At this point, the engine is suggesting another approach. Gently turn the prop counterclockwise until it meets the resistance of compression, then stop. Now smack the prop smartly away from compression, not through it, in the clockwise direction. A well-primed engine often will be more likely to start with this approach. In fact, it is the most common method used by combat and racing pit crews with cold starts.

If that doesn't work in the first few tries, check the bump again. If it's still there but less violent, try flipping the prop smartly counterclockwise through compression in the usual way; the flood has reduced and the traditional approach is likely to work.

If the bump disappears completely, it's probably time for another prime, or possi-



Brodak Distributing Co. has just released its new three-line Brodak/J. Roberts handle and a full line of three-line bellcranks. New catalog is now available—see text for information. Photo by John Thompson.

bly a couple of turns of choking. Resist the tendency to prime both the exhaust and the venturi; the exhaust prime is enough, and the venturi prime will either be inefficient or will flood the engine.

The optimum setting for a running engine varies on how it will be used. You have probably heard the terms "two-cycle" and "four-cycle," which are used to describe an engine's running sound. An engine in the



Jim Cameron (left) of Portland, Oregon has been a die-hard flier for many years. He recently helped Gary Harris (right) of Hillsboro, Oregon get his Academy of Model Aeronautics all-weather patch—and snow was included in the 1993 winter conditions! Both are members of the Portland-area Northwest Fireballs club. Photo provided by Jim Cameron.



Wayne Spears of Portland can be counted on to produce interesting planes. This one is a Boxcar Chief, kitted in the 1940s by Rich Manufacturing. Note the old O&R .60 spark ignition engine. John Thompson photo.

"four-cycle" mode is firing on every fourth stroke (up and down strokes of the piston being counted separately), or every second full turn of the crankshaft. A "two-cycling" engine is firing every time the piston comes up, or every second stroke—once every full turn of the crankshaft. To the ear, the difference is obvious. The four-cycling engine has a low, growling sound, while the two-cycling engine has a much higher pitch. As you adjust the needle valve from a rich to a lean setting, there will be a point at which the engine will "break," and the tone will change noticeably.

The best setting for general sport flying, which includes most of the flying done by new CL pilots, is a strong four-cycle run. Certain engines, such as the Fox .35 Stunt, can be set at an rpm just under the break to two-cycling, and they will go into a two-cycle on maneuvers—an ideal situation.

One of the common mistakes of new fliers is to set the engine at its strongest sound: a screaming two-cycle. However, when the airplane takes off, the engine may go over-lean and be damaged from overheating and underlubrication; at the least, you will be flying much faster and working the engine much harder than optimum. The common sport engine is designed to run on the rich side. Also,

many commercially produced suction tanks will cause the engine to lean out as the flight progresses, so starting with a lean run is asking for trouble.

Once you have had one or more successful flights at a good needle setting, avoid the temptation to tweak the needle valve before starting the next time. Once set, the fuel mixture will usually remain at or near optimum from flight to flight and even from day to day. If the engine does not start immediately, review the starting instructions above but leave the needle valve alone until the engine is running. Use priming and choking to get fuel to the engine; twisting the needle valve will just cause you to lose your setting. Once the engine is running, a slight adjustment may be needed.

Another running tip: An engine that is still warm from a previous run usually does not need a prime and may flood and become impossible to start if it gets an unnecessary prime. Try starting it without a prime. If it won't start and you are sure it is dry, use the above method for a measured exhaust prime but give the engine only about half the amount you'd give it for a cold start. Sometimes just a choke is enough. Once again, *don't* prime the venturi; if the engine has just been run it probably has enough fuel in the crankcase and would just flood

with a venturi prime.

If you over-prime, even with a cold engine, you may produce a flooded condition. This will be indicated by an extremely violent bump, after which the engine refuses to start, or by a "locking" of the engine so you can't even turn it over. It also may be that the engine simply refuses to respond to flipping, though you may hear the fuel sizzling on the glow plug. Sometimes, just repeated flipping will clear the flood. Backward flipping through compression will help clear flooding; when the engine starts to respond, you may want to switch to the backward flip away from compression.

The special handling mentioned above for muffled engines is due to the difficulty in priming through the muffler. It can be done, but it is difficult to measure the prime. In most cases, it's better not to try; it may take a little more flipping until you gain experience, but an inexact prime can cause more trouble than it's worth.

Instead, just make sure that fuel is in all the right places through other means. After filling the tank, plug the overflow vent and keep feeding in fuel just for an instant, to make sure the tube to the engine is full of fuel and that some has been forced into the crankcase. Flip the prop a few times to loosen everything up. Connect the battery and turn the engine over, feeling for the bump. If there is none, choke a few times. Then, even if there's still no bump, try starting the engine. Try to avoid flooding because it may be more difficult to clear the flood from a muffled engine. More choking may be needed, but the engine eventually should begin to respond.

There's a great deal more that could be said about engine starting and running, and we may touch on it in future columns. If you have questions about basic engine operation, send them in.

• • •

Good news for control line fliers: Brodak Distributing Co., a large distributor catering primarily to CL enthusiasts, has begun manufacturing and selling a line of three-line handles and bellcranks.

The name of the products—the Brodak/J. Roberts 3-line Bellcrank System—indicates that this is a product with a thoroughbred lineage, as the J. Roberts system is well-known among carrier and scale fliers using throttle or other options. The handles are accompanied by a wide range of different styles of three-line bellcranks for all applications.

For a brochure about the three-line system, as well as Brodak's catalog of other CL products, write Brodak Distributing Co., 100 Park Ave., Carmichaels, PA 15320. The latest catalog comprises 90 pages and sells for \$3.00.

Model Builder readers would like to see photos of CL planes and activities in your area. Send photos, along with club news, contest reports, technical tips and questions, to John Thompson, 295 W. 38th Ave., Eugene, OR 97405. **MB**

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HANNAN'S HANGAR

BY BILL HANNAN

"Modeling is an art. The drafting board is its brush, the workbench its paint, and the sky its canvas."



Really big! At the time of this photo, Ian Turney-White, of England, had logged 12 flights on his 1/2-size, 16-foot span RC Avro triplane Mk.4. We'd love to see some footage of this one in action.

Our quotation this month, by Ken Sykora, was found in the brand new, hot-off-the-press Oldtimer Model Supply Catalog. Illustrated by Otto Kuhni and Mik Mikkelsen, this fun-to-read booklet features an amazing variety of offerings, including model construction plans (scale and non-scale) and building materials such as balsa, bamboo, Japanese tissue, condenser paper, propeller blanks, turned balsa wheels, colored

nitrate dope and much more. Ken refers to his mail-order company as a "1930s model shop," and that describes it quite well. You can obtain a copy of his catalog by sending \$2.00 to Oldtimer Model Supply, Box 7334, Van Nuys, CA 91409.

VINTAGE THINKING

Interest in older aircraft seems to be increasing, judging by the photographs we receive. Doubtless the insatiable appetite for anything nostalgic has something to do with it; however, the fact that early aircraft were practically overgrown models, with similar construction, may also be a contributing factor. Duplicating spruce and fabric with sticks and tissue is much more logical than attempting to simulate formed sheet aluminum with balsa wood!

Our photo subjects encompass aviation history from the pioneer times through World War One and into the Golden Age, and cover the model size spectrum from tiny to huge. There is a special character to vintage aircraft which sets them apart from more modern "heavy metal" subjects, and it can be

satisfying to resurrect these oldies and put them back into the air. As model designer Roy L. Clough Jr. so aptly put it: "You can have one foot in the past and one foot in the present."

MORE FEMALE MAIL

Approving letters regarding our women-in-modeling features continue to arrive, and we'd like to share the following extracts: "... What a great thing you are doing, giving credit to the distaff participants in our hobby. Of course, I'm partial to members of our Cactus Squadron, Jane Schlosberg and Glenna Tarango, but it doesn't stop there. . . you might consider mentioning Ann Eckerson. . . while active, she headed the New Mexico Free Flyers Club, and was responsible for introducing several young people to model building. A very nice lady!" Dick Howard, Arizona.

"My wife is the one who got me back into building Peanuts." James Miller, Hong Kong.

NO WOMEN IN THE WIND

John Garrett, of Costa Mesa, California, sent in a copy of the



Beautifully constructed dummy ABC Scorpion engine and adjustable-pitch propeller, ready to mount on Tom Hallman's rubber-powered Jumbo Scale 1929 Henderson-Glenny Gadfly.

April 1912 San Diego Aero Club airshow program, in which we found this item: "Ninth Event—Flight by Miss Julia Clark. (In accordance with ruling by the meet officials, Miss Clark will not be permitted to fly if a wind is blowing)." We can only imagine what the reaction would be today!

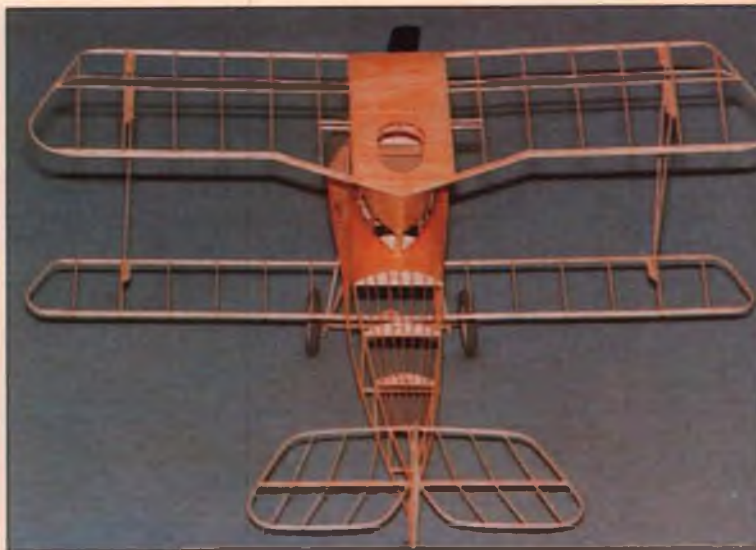
NEW PLANS AND PUBLICATIONS

The second in the Domeduster indoor model plans packets has been announced. Featuring a Dave Linstrum drawing of a Czechoslovakian Avia racer on its cover, the pack features 12 plans by nine different designers. Included are four Peanuts, two Pistachios, two Ministicks, a Bostonian, an EZB, a Pennyplane, and a catapult

glider. Priced at \$8.00 post-paid, Packet #2 may be ordered from Stan Fink, 1810 Pine St., Philadelphia, PA 19103.

North American AJ-1 Savage, by Steve Ginter, is devoted to an unusual tri-motor U.S. Navy carrier aircraft, with two reciprocating and one jet engine. ("Two turning and one burning.") This 130-page book includes descriptive history, many photos, three-views and detail drawings.

The proportions of the Savage lend themselves to a flying model, and in fact, Dick Howard has a free flight version successfully flying. As an RC subject, the AJ-1 would offer many possibilities, considering its propulsion arrangement, folding wings and vertical tail. The book is priced at



Dr. Harvey Pastel's intriguing 1916 Sage #2 rubber scale model spans 17-3/4 inches and weighs 2 ounces in completed form.

\$19.95 plus \$1.50 postage and handling, from Steve Ginter, 1754 Warfield Circle, Simi Valley, CA 93063.

Black Widow, the Story of the Northrop P-61, by David R. McLaren, concerns the first aircraft specifically designed to perform in the dark and under adverse weather conditions. First flown during 1942, the sinister-looking twin-boomed Black Widow gained an excellent reputation among its pi-

lots, not only in wartime use but also in experimental roles, such as towing a propellerless (!) P-51 Mustang aloft, high-altitude ballistics tests, ejection seat check-outs and weather investigations for NASA. In addition to specifications, squadron/unit and serial numbers listings, this 122-page book features a three-view drawing by Bill Wylam. Regrettably, many of the rare photographs leave much to be desired, as acknowledged by the publishers. *Black*



This incredibly detailed 1/4-size Fokker D.VII is the handiwork of master modeler Dick Enos. Plans, technical details and this photo were supplied by Dan Dodson of Santa Maria, California.



Vintage accessories from the collection of Jim Poche include a variety of rubber-power model propellers, spun aluminum ring cowlings and molded celluloid dummy radial engines. All are rarities today.

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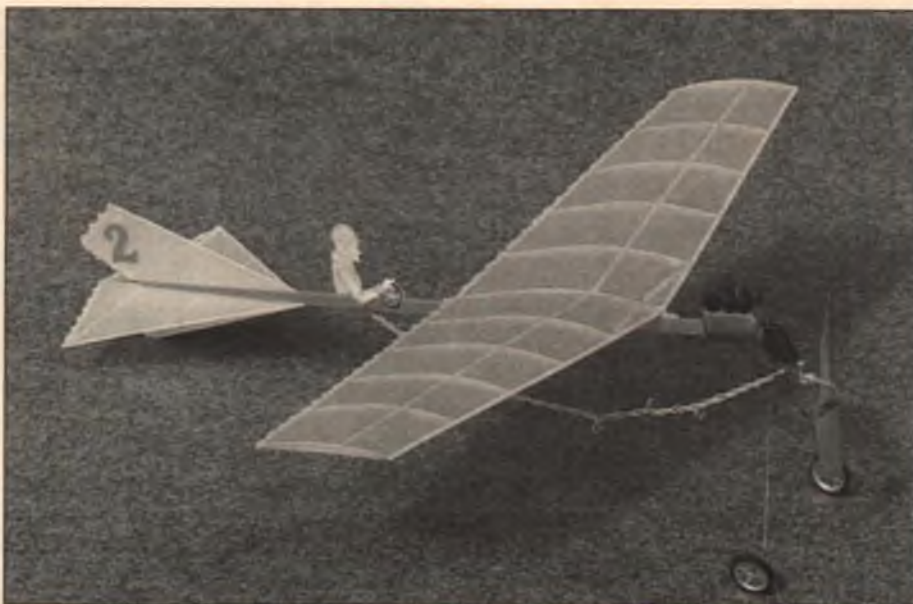
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HANNAN'S HANGAR



Delightfully simple AM/FM (Antique Model Flying Machine) by George Benson spans 20 inches and averages 50 seconds duration. Note those intricately scalloped trailing edges!

Widow is available for \$16.95 plus \$2.50 postage and handling, from VIP Publishers, Inc., Box 16103, Colorado Springs, CO 80935.

When contacting any of the named firms, kindly mention *Model Builder*. Thank you!

HEALTHFUL HOBBIES?

A longtime friend, Bruce Walton, of Morgan Hill, California, wrote to say how much he had appreciated one of my philosophical tidbits, in which I stated: "I don't feel the least bit self-conscious about playing with toys. On the contrary, they may be my fountain of youth."

Bruce explained that he had read that item only a few days preceding a routine physical examination: "Like most males, I avoid going to doctors except in the most dire of circumstances. . . . After admonishing me for being somewhat overweight, Dr. Callaway smiled and proclaimed, 'You're in really great shape, your tests came back just fine.' He went on to comment that he had not expected the results to be so bright, because he remembered the high-stress environment I have been a part of, during a career spanning more than 35 years in civilian and military space programs.

"I told him that my activities with model railroading, and a love of building and playing with toys, going back to the 1930s, helps me to stay young at heart. The doctor smiled again and said, 'We have found that those individuals who don't give up a part of the child in all of us, but instead nurture it as they grow older, live longer and

healthier lives.'"

So there you have it, another good reason for being a model builder!

SPEAKING OF THAT "INNER CHILD"

Ed Whitten, of New York, favored us with two newspaper clippings that tie in nicely. The first, from the *New York Times*, explained the importance of play in developing a child's coordination and problem-solving abilities, imagination and even memory efficiency. Reporter Jane E. Brody quoted child development expert Dr. Jerome Kagan, who defines "play" as anything you do and enjoy free of coercion: "You have to ask, 'How much fun is it? Are you enjoying what you're doing?' If you have a great time at your work, you're playing." By contrast, he noted that some people who take play too seriously are really working.

The second article, authored by Calvin Simms, asserts that more parents are now buying toys for themselves, as well as for their offspring. Mentioned were toy cars, electronic games and stuffed animals being purchased by both men and women. With some of the prices quoted, such as a \$600 doll and a \$250 designer doll dress, it seems unlikely that children will ever have a chance to even touch them until they are adults!

The message seems to be that "playing with toys" is an important part of living, something we've known all along, right? Certainly we owe no apologies to people who may be less enlightened. Let's all have more fun! **MB**

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Inspired by Aviation's Golden Era. Although it looks like it's straight out of the 1930's, don't bother looking up this one in your aviation history books. The Spacewalker was designed by Jesse Anglin of Hendersonville, North Carolina, and first flew in 1986! Despite the fact that it is a new design, the Spacewalker manages to capture all the spirit of Aviation's Golden Era.

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EZ Mystic 30

With its attractive five-color trim scheme, the Mystic 30 is one sharp looking model. Ship was designed by pattern legend Hanno Prettnier, so you can be sure it's going to be a hot performer.



■ ABOVE: Close-up shot of the Magnum 35 PRO SE installation in the Mystic's nose. An has lots of good things to say about this exceptionally powerful new engine. ■ RIGHT: The author (left) poses with expert test pilot Jerry Kitchin, who was recruited to do the Mystic's test flights.





■ LEFT: In a convincing demonstration of sheer power, the Magnum PRO .36 SE hauls the Mystic 30 straight up out of an assistant's hands. ■ ABOVE: A low fly-by reveals the Mystic's short landing gear, which limits props to 9-inch diameter. Optional retracts are also available—contact Global for particulars.



ALL ABOUT ARFS BY ART STEINBERG

This month we will take a close look at the Mystic 30, one of the excellent EZ series of ARFs distributed by Global Hobby Distributors. The Mystic is a small, attractive pattern-type taildragger designed by Hanno Prettnner, six-time World Champion and arguably the most skilled flier and designer in RC history. The ship spans just 52 inches and is designed for .25-.35 two-stroke or .40-.48 four-stroke engines. Like any full-size competition pattern

EZ MYSTIC 30

WINGSPAN	52 in.
WING AREA	465 sq. in.
OVERALL LENGTH	43-1/2 in.
FLYING WEIGHT	65 oz.
WING LOADING	20 oz./sq. ft.
POWER25-.35 two-stroke, .40-.48 four-stroke
DISTRIBUTOR	Global Hobby Distributors, 10725 Ellis Ave., Suite E, Fountain Valley, CA 92728-8610.

Underside view shows a completely different trim scheme than is used on the top, making it easy to instantly determine the model's attitude in flight.



The Magnum PRO .36 SE ABC



The Magnum people have come a long way in achieving their goal of producing a line of engines second to none. All of the PRO series engines are equipped with dual ball bearings, Schnuerle porting, an ABC piston/cylinder assembly and an automatic mixture control carburetor.

The Magnum PRO .36 SE is beautifully

finished and has an attractive squared-off cylinder. Rated at 1.0 bhp at 14,500 rpm, it weighs in at only 11.4 ounces including the muffler. The directions recommend that it be broken in with a 10x6 prop, but this left too little ground clearance on the Mystic 30. I chose a 9x7 instead.

The specs list the maximum rpm range as 2,000 to 17,000, and the practical range as 2,500 to 14,000 rpm. Using Powermaster 15 percent nitro fuel and keeping the engine slightly on the rich side, my tach indicated 14,100 rpm at high throttle. After about 20 minutes of break-in, further needle valve adjustment yielded a steady 14,700 rpm.

At no time during subsequent flight testing did this magnificent little powerplant miss a beat. Idle was remarkably reliable right down to 2,700 rpm. I didn't even try to get it lower, as it seemed to be already as low as one could want. Transition from low to high range was instantaneous, without a hint of hesitation. The muffler is very effi-

cient, and though we didn't check it with a meter, the engine seemed reasonably quiet to me.

Sounds perfect, doesn't it? It would seem to be the ideal small plane engine, especially considering its suggested retail price of only \$139.95. The one fly in the ointment was that although I tried several different glow plugs, some with idle bars and some without, the engine was burning out a plug on each flight, a side effect often encountered with high-performance engines. I finally solved the problem by using a very cold Rossi R5 plug, the same one I use on my tuned pipe engines, and which rarely seem to burn out. Using the Rossi plug, the engine continued to deliver maximum revs and a great idle.

So if you are tired of paying big bucks for high-performance engines and want to brighten up your flying and dazzle your friends, get yourself a Magnum PRO .36 SE ABC and join the big boys! **MB**

Model, it has a fully symmetrical airfoil and an especially long tail moment to smooth out the most intricate maneuvers.

As luck would have it, just about the time I acquired the Mystic 30 kit, a brand new Magnum engine became available from

Global Hobby Distributors: the Magnum PRO .36 SE, a state-of-the-art ABC two-stroke. I had heard that the engine was

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"Contact your local hobby dealer first" If he doesn't have what you need, order direct from England Enterprises at 916-661-6515

claimed to be exceptionally powerful, so I obtained one for the Mystic 30. As it turned out, I couldn't have made a better choice—but more about that later.

Assembly of the airplane went smoothly, with every part an excellent fit. The construction is typical of the EZ series models—a wood framework covered with laminated foam board, topped off with what I feel is the most attractive color scheme I've seen on any ARF. All of the finished surfaces are covered with a tough mylar coating and are completely fuelproof. The bottom of the wing and horizontal stab bear entirely different colors from the top, making it a snap to distinguish top from bottom in the air.

Following the usual techniques used with most EZ models, the wing halves are joined with epoxy and the tail feathers are epoxied to the fuselage. Plastic cover plates cover the center wing joints, and a nice plastic fairing goes over the tail surfaces. Thin CA was used for all plastic-to-plastic joints.

The Mystic 30 is thoughtfully designed to accommodate a piped engine, as there is a channel for a pipe designed into the belly of the fuselage. Additionally, a pipe holder and mounting hardware are included in the kit. I chose not to use a pipe, at least not at first, as I was more interested in seeing what the Magnum engine would do with its standard muffler.

Typical of EZ models, every necessary hardware item is supplied, with enough extra nylon horns, clevises, etc. to stock a spare parts bin. Complete mounting hardware for a retract gear setup is also included, but in the interest of simplicity and light weight I went with the standard fixed gear.

All hinge slots are factory machined and required some cleaning up before the control surfaces were attached using the brass hinges supplied in the kit. These were secured installed permanently with five-minute epoxy.

There isn't a lot of room to work with in the fuselage, so when it came time to install the radio I thought I might have to use a mini receiver and servos. Fortunately, my son is a real whiz at radio installations, and managed to squeeze in a standard Airtronics six-channel receiver along with a 500-mAH flat battery pack. But forget about foam packing—there just isn't room for it. He used two mini servos for the elevator and rudder and a micro servo for the throttle, which he mounted in the fuel tank compartment. The wing easily accommodated a standard servo.

The only real difficulty I encountered was assembling the cowl. This comes in two pieces, which I joined together, then reinforced on the inside with a strip of glass cloth. However, the front face of the cowl ended up being badly tilted in relation to the spinner backplate. I corrected this by adding a 1/8-inch plywood plate to the face of the cowl and sanding it to a wedge shape.

The 24-page instruction book which

guides the builder through the assembly of the Mystic 30 is clearly written in both English and Japanese and includes many black-and-white photographs. A number of critical points are not thoroughly explained or demonstrated in the photos, but then, we are not dealing with anything remotely resembling a trainer, and I would expect anyone tackling this project to be an experienced RC pilot who can read between the lines when the instructions are not totally explicit. However, when it comes to preparing the model for flight, the instructions are outstanding. Directions for CG location, control throw limits, engine thrust, and even balancing the wing are simply written and easy to understand.

The Mystic 30 is a truly beautiful airplane, with its long moments and graceful lines. The factory specs indicated a flying weight of 67 to 70 ounces, but I was pleased to find that mine came out at only 65 ounces, probably due to the use of the lightweight servos and going easy on the epoxy. With a wing area of 465 square inches, the wing loading calculated out at only 20 ounces per square foot—pretty much on the light side.

Test pilot for my Mystic 30 was Jerry Kitchen, a top-notch RC flier. As I intended to give the Magnum .36 an in-flight break-in, the needle was set toward the rich side. Even so, the lightweight model accelerated instantly and was off the ground in no time.

There's nothing Jerry can't do, given a

capable airplane, and as he went into a full vertical climb, we knew this was far more than just a capable airplane! Attesting to the well-aligned construction, the only trim required was two clicks of right aileron and one click of up elevator. This done, Jerry commenced to put the ship through its paces while all of us, Jerry included, marveled at its aerobatic abilities.

Not a person given to overstatement or exaggeration, Jerry kept uttering words like "awesome" and "unbelievable." On the next flight he put the airplane through his freestyle flight routine. He began the flight with a stunt he usually performs only with his own showplane, which is equipped with a YS 1.20 four-stroke. With an assistant holding the plane with the nose pointed straight up, Jerry applied full power and did a vertical takeoff right out of his helper's hands! During this flight I asked for a turn on the sticks and took over in mid-flight. The airplane makes even a so-so pilot like me look good with its smooth flying characteristics.

The Mystic 30 is more than just an airplane for the experienced flier. My feeling is that if you haven't flown a plane of this caliber, you have yet to know what *real* RC flight is like, and I can't think of anything else in its class that can do as good a job.

For availability, contact your local dealer or Global Hobby Distributors, 10725 Ellis Ave., Suite E, Fountain Valley, CA 92728-8610. **MB**

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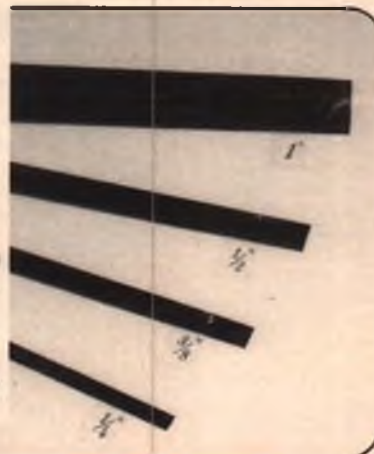
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ELECTRONICS CORNER

BY ELOY MAREZ

•High-Voltage Battery Chargers •Developments in Solar and Lithium Technology

Batteries and battery chargers are easily the two most popular subjects here in EC, at least as far as my mail is concerned. So I guess it is safe to start this month's discussion with them. In this case, we are dealing with the use of high voltage, high cell count, 12-volt DC-powered chargers such as those produced by Astro Flight, SR Batteries and others for charging the bigger electric power systems.

Some basics first! We will be dealing with watts, which is the basic unit for the measurement of electrical energy. It is defined as the amount of power expended by 1 ampere of current flowing through a 1-ohm resistor. Watts, or more correctly wattage, is the product of the applied voltage times the current—volts times amps. Other terms you will encounter will be milliwatt—1/1000 watt, useful for calculations of less

than 1 watt; and kilowatt—1000 watts, a value useful for calculating your electric bill but of little use here!

Another point to keep in mind where all battery charging is concerned is that in terms of watts expended, it is at best a very inefficient operation. That is, we can calculate very accurately exactly how many watts we have taken out of the basic power source, be it the nearest wall plug or that heavy-duty 12-volt battery you lug out to the field. However, after calculating just how much energy (again in watts) is available to us in the newly charged flight battery, you will find a considerable difference. With so many variables, I can't begin to give you exact figures for your particular combination, however, efficiencies as low as 50 percent are not uncommon. Think about it—that is like boiling out a gallon of gas for every gallon

actually burned by your car on the way to the flying field!

More basics—this time about battery charging. The first completely inflexible rule about charging a battery is that the charging voltage has to be higher than the charged battery voltage. The second such rule is that the higher the applied voltage, the higher the charging current. In a simple fixed-current charger, the desired current level is arrived at by using the proper transformer, with possibly a series resistor to fine-trim things. In the common type of variable charger, we start with a high rate, reducing it as required with a variable resistor. The more sophisticated chargers which use voltage pulses to revive batteries generally increase the average current by increasing the length of the pulses, i.e., increasing the on-to-off ratio.

Now, the majority of us are using either an automotive 12-volt battery, or one of the commercial 12-volt DC power supplies that have become so plentiful. These latter power supplies are not overly expensive, and being freed from that heavy, bulky battery—and its charging requirements—certainly makes them an attractive item to add to our support equipment.

Regardless of the system in use, the 12-volt source limits the number of cells that can be charged; seven being the most that will permit any serious amounts of current to flow. How, then, do the Astro and SR chargers manage to charge those many-cell packs? Well, there is no magic—they have to increase that voltage to one higher than the battery voltage! Though not exactly difficult, a large number of heavy (current-wise) components are required, which is why such chargers are quite a bit more expensive than ones limited to only seven cells.

You will remember that a transformer is used to step up a voltage. However, since transformers do not work with DC, the 12-volt input first has to be



A most useful, recommended accessory, the AVS Thompson Adjustable Voltage Converter reduces a 12- to 15-volt battery or power supply output to 0 to 10 volts for direct operation of motors, dynos and all motor testers, speed controls—anything requiring less than the full voltage. Output has been tested as clean and extremely well regulated. Two versions are available: 18A (\$69) and 28A (\$89). Info and orders: AVS Electronics, 4586 Turney Rd., Cleveland, OH 44105; (800) 237-0287.

changed to AC in an oscillator circuit, then fed to the transformer. The result is a higher voltage, which, now being AC, has to be rectified back to DC to charge the battery. Seems like the long way around, doesn't it? Besides which, the whole process is subject to losses; a circuit in which the output power is exactly the same as the input has not yet been developed in anything electronic.

Now come those watts we were talking about! Say that we are using a 12-volt power supply which is rated at 10 amps. (A clarification is probably in order for some of you. The 10 amps does not mean that such a current will flow through anything connected to the supply; it indicates the maximum current that it can furnish.) According to our volts-times-amps formula mentioned earlier, this power supply is capable of producing 120 watts.

Fine, except that should we connect one of the high-voltage chargers to this same power supply, its output could not possibly be more than these same 120 watts in any way. Actually it will be less, due to inherent losses. For the sake of simplicity, let's say your charger steps up the voltage to exactly double; 24 volts. Working our formula backwards, the available current is then only 5 amps ($120W/24V=5A$). Should the charging voltage be stepped up to 36 volts, the available current would only be 3.33 amps. In other words, the output of the charger is limited, in watts, to the total amount of electrical energy supplied to it, and no matter how you juggle the values, they cannot total up to more watts.

What happens when you exceed the limits? It really depends on the equipment you have, though in all cases, things

will simply appear to be dead. Most of the better power supplies have fuses or cutoff devices which will do their thing and kill the output. Fortunately, seldom will any permanent damage occur to anything.

The losses mentioned? Again, anytime you adjust or modify a voltage, or control a current, there are losses, and we sense them as heat all along the charg-

sounds like it should fly well. It is described as "a little kit with some light paper, a stick, and extensively detailed, but simple instructions. When you have followed the instructions, you will have two little airplanes, to each of which you will have attached one (or for extra speed, two) live houseflies. The fly provides the motive power and they really do fly."

Parade.

The differences between these new and the more common solar cells is that unlike the latter, which are fragile and brittle, Spheral Solar cells are composed of thousands of tiny spheres housed in thin aluminum foil. The material is flexible, lightweight and durable. Also, the new cells are composed of an inexpensive low-

purity silicon, previously considered completely unusable. Research has shown that a 10-foot Spheral Solar system can produce about 2,000 kilowatt-hours annually. To get an idea of just what that means, take a look at your electric bill, which is calculated in kWh. My last one was 184!

Another interesting development, which might have more of an impact on RC than anything solar, came to my attention through the courtesy of reader Jose Tellez, of Laguna Beach, California. It deals with (get this): re-

chargeable lithium cells. Lithium cells have a greater energy density than most other types; i.e., they produce more watts for their size and weight. The cells mentioned in Jose's information are made by a company called Valence Technology, in San Jose, California.

Interestingly enough, these cells are apparently already available; the news release states that they are being used by Motorola in cellular phones, pagers, and two-way portable radios. The bad news there, of course, is that the latter two are a couple of the things that can cause "I ain't got it" situations for us RCers.

See how easy it is to get your name immortalized in EC? Just send in some news worth sharing!

Eloy Marez, 2626 W. Northwood, Santa Ana, CA 92704. **MB**



"First the wheel, now this. I wonder where Eloy gets all these great ideas?"

ing system. Some you can't do anything about—live with it, but other sources of heat, such as poor connections, battery clips, etc. that can be eliminated will improve the overall efficiency of your charging system.

WEE RC'ERS, ACHTUNG!

Though I know this is going to offend some of you, I have to share it with you. I didn't order one—I'm just telling you about it.

I recently received an interesting catalog from a company named American Science and Surplus (P.O. Box 48838, Niles, IL 60714). It is 64 pages of everything from AC motors to tools, according to the index. Lots of gadgets dear to the tinkerer, electronic items. . . a little of everything. Included is even a little model plane which

Well, except for the opposition that will no doubt be launched by the "Save The Flies" movement, maybe this is the start of a new AMA class. As for Wee RC, we'll have to check with Fritz Mueller as to just how light he has been able to get those Albin receivers. . .

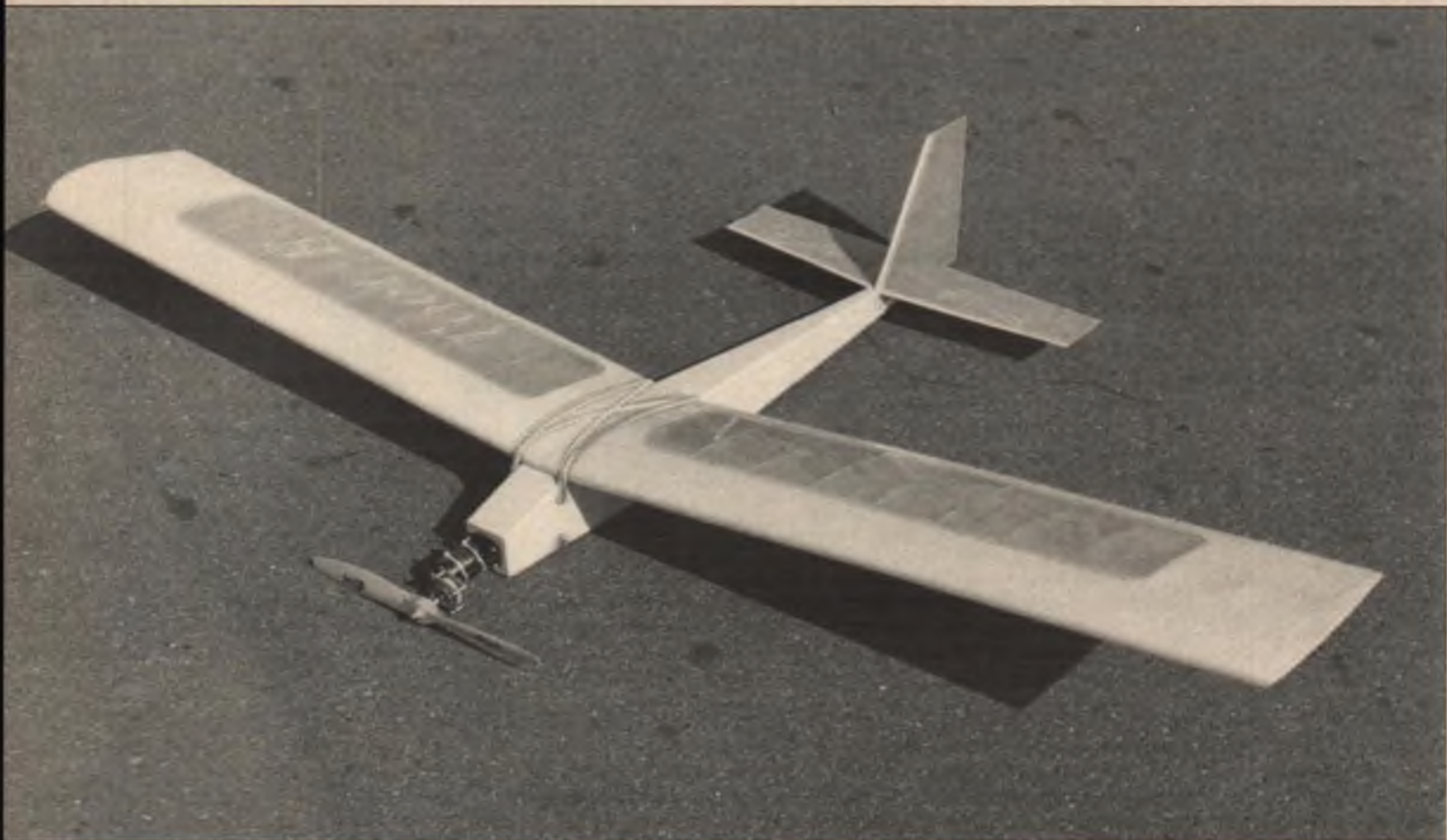
BACK TO WATTS AGAIN!

There have been a couple of new developments that should make life considerably brighter for the RCer (pun intended!). It may be a while, but then again, the first NiCds were far from being the reliable power source they've come to be.

First is a solar energy development by the Edison Company in conjunction with Texas Instruments, a type of solar cell called "Spheral Solar," which was in fact used to power Edison's entry in this year's Rose

THE MODEL ELECTRONICS ELECTRIC POWER SYSTEM

Our columnist puts the "War Emergency Power" flight system to the test,
with some pretty impressive results!



Roger chose his faithful "Toot-E" trainer as a test-bed for the Model Electronics power system and was quite impressed by the performance it delivered. The unit is currently being tested in other models, and the results will be reported here as they become available.

Roland Peterson of Model Electronics (6500 6th Ave. N.W., Seattle, WA 98117; 206-782-7458) was kind enough to send me one of his War Emergency Power motors along with a gearbox and an Electro System speed control and battery eliminator module for testing. These items along with other motors and even some kits are currently being advertised by Model Electronics. Since I am like a kid in a candy store when I get a box of electric stuff in the mail, I eagerly went to work putting the pieces together.

THE WEP SYSTEM

Roland sent me four plastic bags full of

goodies. The motor and a couple of discrete electronic components were in one, the gearbox parts were in another, the third bag had the MOSFET power cord, and the fourth bag had the controller.

Motor

Motor preparation consists of soldering a diode and capacitor to the back of the motor. (The diode is there to prevent back voltage from damaging the speed control unit.) The illustration clearly shows the component wiring and power connections. Pay close attention when soldering the diode; it must be connected the right way or it will be destroyed the first time power is applied.

Roland believes in "a picture saying a thousand words," and the set of assembly instructions reflects this philosophy. The exploded drawing of the motor showing the case, armature, endbell, and brush installation left nothing to the imagination. This same page had information about motor break-in, motor operation, lubrication and cleaning.

Unlike most other motors, you cannot merely switch polarity to reverse the motor direction. To change the WEP motor's direction, you need to unscrew the mounting screws from the endbell, turn it 180 degrees and then re-secure it to the motor.

The speed control modules consist of the

controller and the MOSFET power cord. Because the two modules are wrapped tightly with heat-shrink tubing, it was difficult to tell what each one does. My guess is that the larger one controls the power to the motor and the smaller one acts as a battery eliminator circuit and interface between the receiver and speed control. In this configuration, power is supplied from the motor battery to the receiver through the throttle connector.

Assembly of the speed control units is easy enough. First you install the connection to the motor, then to the battery, then you install a connector to match your receiver. If you use Sermos connectors for the rest of the motor and battery connections,

main shaft and related parts. I had to wing it, and fortunately everything went together properly. Some additional detail on this assembly with the backplate, spur gear and set screw positions clearly shown would be very helpful.

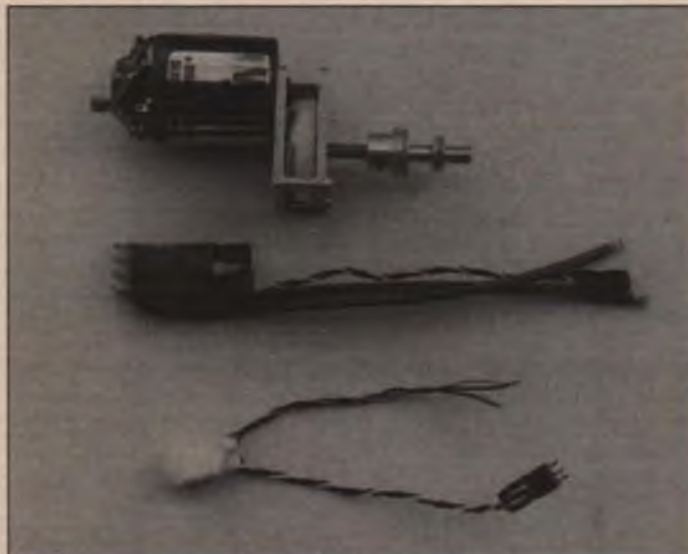
After the gearbox was assembled, I applied some grease to the spur gear, pressed the pinion gear onto the motor shaft and attached the motor to the gearbox with the machine screws provided in the kit.

Weights and Bench Testing

When everything was put together I pulled out my postage scale and weighed all of the equipment. Table 1 sums up my results. Next, I measured rpm and current with

I attached the motor to the firewall using a Sonicronics motor mount, stuffed the speed control units and the battery pack into the fuselage and headed for the flying field. My takeoffs (hand launched) were as Roland promised—almost straight up! In fact, the WEP motor with the 6:1 gearbox was almost too much power. If the plane was pulled to an extreme nose-high attitude, the torque from the geared motor system would spin the plane around. It was best to keep the attitude to less than 30 degrees and keep the airspeed up.

Flight duration averaged about 7 minutes; total motor run was about 3 minutes. This was on a day with zero lift and quite a bit of sink—not very good soaring weather.



■ LEFT: The complete War Emergency Power system with the motor and assembled gearbox (top), MOSFET power cord (middle), and controller (bottom). ■ ABOVE: Close-up of the War Emergency Power system installed in the Toot-E. This particular setup uses the WEP motor fitted with the 6:1 gearbox, swinging a 13x7 Zinger prop on seven cells. The WEP power system is actually designed to be run on up to nine cells, with a dramatic increase in performance.

be sure you mark which set of connectors goes to the motor and which set goes to the battery.

The speed control adjustment instructions were easy to follow. My unit came out of the bag adjusted properly—I didn't need to fine tune it at all.

Gearbox

The gearbox is supplied disassembled—lots of little pieces to put together! Spur gears are available with 34, 36, 38 and 60 teeth; pinion gears come with 10, 12 or 14 teeth. Roland sent me the 60-tooth spur gear and a 10-tooth pinion gear, making the gear ratio 6:1. In addition to the 6:1 ratio I had, ratios from 2.42:1 to 3.8:1 are available.

Assembling the gearbox was not as easy as putting together the rest of the system because the instructions for the gearbox are rather ambiguous. There are a number of drawings for the different types of gearboxes that Model Electronics sells; none of them are clearly illustrated, and the written instructions are of little help. After studying the drawings for 30 minutes and matching up the parts in the drawing with the parts I had, I figured out which illustration I should be following. The drawing detailed the assembly of the gearbox frame but not the

TABLE 1.

WEP COMPONENT WEIGHTS

Gearbox	1.5 oz.
Controller	0.5 oz.
MOSFET Power Cord	1.0 oz.
WEP Motor	6.5 oz.
Battery Pack (7 cells, 1200 mAH)	13.0 oz.
Battery Pack (7 cells, 900 mAH)	9.5 oz.
Total WEP system with 7-cell, 1200-mAH pack	22.5 oz.
Total WEP system with 7-cell, 900-mAH pack	19.0 oz.

different propellers. All of my tests were run with the battery fully charged. Table 2 summarizes these tests.

Flight Testing

I used my old reliable Toot-E powered glider as a test-bed for the WEP motor system. The Toot-E has a 66-inch wingspan, weighs 45 ounces ready to fly with a 1200-mAH battery pack and uses rudder/elevator/throttle controls. It is not a fast plane, but it gives a good indication of motor performance. Other tests with other people's airplanes will follow in a future column—more on that later.

TABLE 2.

WEP PERFORMANCE TESTS

All tests were run with a wood prop and a fully charged seven-cell, 1200-mAH battery pack.

Prop	RPM	Current Draw
12x7	5,300	19 A
13x8	5,000	26 A
13x10	4,800	27 A
12x6	5,500	18 A
11x7	5,700	16 A
9x4	6,800	10 A

With each flight I got four motor runs of 30 to 45 seconds each. The plane would climb 200 to 300 feet with each motor run.

All in all, the WEP motor system performed flawlessly and as advertised. This motor does indeed seem to be more powerful than an Astro Flight 05 running on the same seven-cell pack, however, the extra power comes at the expense of duration. Roland tells me that although the WEP system uses a ferrite motor, the armature is much closer to the magnets than other ferrite or cobalt motors, thereby increasing the efficiency of the motor.

According to Roland, the WEP system is



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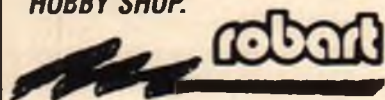
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Gearbox comes as a disassembled kit. Available gear ratios range from 2.42:1 to 6:1.

especially suited for Old Timer aircraft. I didn't have any Old Timers flying at the time of the tests, so I gave the power system to a fellow club member to try out in his model. I'll have his report in a future column.

Gripes

As you may have gathered, I did have some problems with the assembly. In my opinion, the instructions supplied with all of the components should be rewritten to make them clearer. As they are, the written directions are often ambiguous and the illustrations do not show all of the parts. For example, the diode and capacitor that are to be connected to the motor were packaged with the motor, but the instructions on mounting them were on the speed control instruction sheet. The gearbox instructions and diagrams were not labeled adequately, nor were they detailed enough to show the complete assembly. Without help, an inexperienced modeler could have trouble putting this system together. (*Editor's note: Model Electronics became aware of the inadequacies of their written instructions after Roger received his system. Roland Peterson told us the instructions have since been completely redone.*)

Pricing

The War Emergency Power system is priced competitively with other electric systems on the market. According to my pricesheet, the speed control lists for \$94.50, the motor lists for \$80 and the gearbox is priced at \$25. (You should verify these prices with the manufacturer before ordering.) If you order the gearbox, be sure to specify the desired gear ratio so you will get the proper size spur and pinion gears.

All in all, the WEP system performed as advertised, and although the instructions are lacking, the system is worth the price. Now I'd really like to try one of Roland's Incredible Stick aircraft (hint, hint).

IN DEFENSE OF ELECTRICS

Francis Reynolds' "Model Design & Tech-

nical Stuff" column in the May 1993 *Model Builder* describes the limitations of NiCd batteries as used in electric flying. Francis contends that "...electric models can't compete with internal combustion powered models in duration. Some powerful electrics can go very fast or fly straight up, but they can do it only for a short time compared to IC (internal combustion) planes." In his article he also explains the chemical workings of NiCds and describes the early Astro Flight motor size conventions. In closing, Francis says, "Until a better battery comes along, I'm going to stick with internal combustion engines—these simple electric airplanes get too complicated."

Quick to defend what has become my favorite aspect of our RC hobby, I wrote Francis to take exception to some of his comments. It is true that electrics can't be compared to gas-powered planes straight across the board. Obviously an Ugly Stik with a gas engine is superior in performance and duration to the same Ugly Stik outfitted with an electric system. However, I pointed out that by narrowing the scope just a bit, an electric's performance can match or even exceed a gas-powered plane's.

As an example, I told of the semi-monthly gas-powered AT-6 races held by a local club and the electric club's efforts to compete in them. After some experimentation, our crack racing team of Steve Manganelli and Steve Neu put together a House of Balsa AT-6 with an Astro 25 motor and entered a couple of races. In the three heats in which the plane competed, the plane did not finish one heat (because of squirrely ground handling), won once, then suffered a mid-air on takeoff. Returning two months later for a second time, the electric AT-6 did not finish once, came in 2nd twice and won two heats. That each heat only required a few laps around the course worked to the electric's advantage. The motor could be pushed to achieve the most power at the expense of duration. So, under some constraints, electric planes can compete with gas planes.

One of Francis' major complaints is the short duration of electric-powered flight. In my letter, I explained that motors in electric gliders can be turned off and on by radio; batteries can be saved and flying time can be extended appreciably. These types of planes are easy to fly and make excellent trainers. When teaching someone to fly with a trainer, instruction time can be spent flying rather than fiddling with a fussy engine.

For the tinkerers, experimentation has always been an integral part of the hobby. Electric modeling is no exception. Scale electric models have enjoyed tremendous success in the last few years due to the efforts of some truly gifted modelers. Many of these scale electrics have competed with gas models and done very well.

Electrics have become a permanent part of the RC modeling scene, and in areas of the country where space is at a premium and noise is a limiting factor, they are the future. I remember many times when my gas engines were very temperamental—I never could get them to run right. Electric models, like gas models, are only as complicated as you want them to be.

E-POWER DIRECTORY IN THE WORKS

I need your help to spread the word about the glories of electric power. Here are your assignments: First, I would like to compile a list of electric modelers and electric clubs in the United States. I can assure you that the list won't be sold or given to commercial concerns. If you are an electric modeler looking for other electric modelers, send me your name, address and, at your option, your phone number and I'll include it in the list. If you want your electric club included in the list, send me the name of one or two contact people in the club along with their addresses and phone numbers. You may also want to include the location of your flying field and the club's meeting dates, times and locations.

To request a list of modelers and clubs in your area, send me a self-addressed stamped envelope and you'll get it right away. Even though electric modelers and electric clubs are popping up all over the country, they are still relatively scarce, and details about them are hard to obtain. The more we network, the stronger this special part of the hobby will become.

Second, if you are the newsletter editor of your club or you know who the editor is, please ask them to put me on the club's mailing list. I read all the newsletters and correspondence that I receive and am always looking for things to share with other E-power modelers.

I want to thank those who have taken the time to write or call me with your comments. My address is 6462 Sunny Brae Dr., San Diego, CA 92119, or you can call me at (619) 463-4455 (Pacific time) during business hours. **MB**

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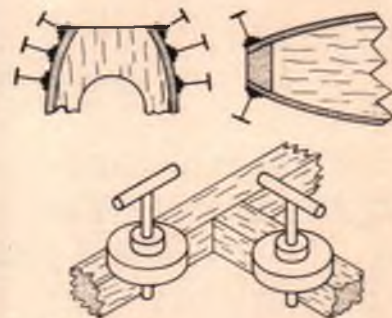
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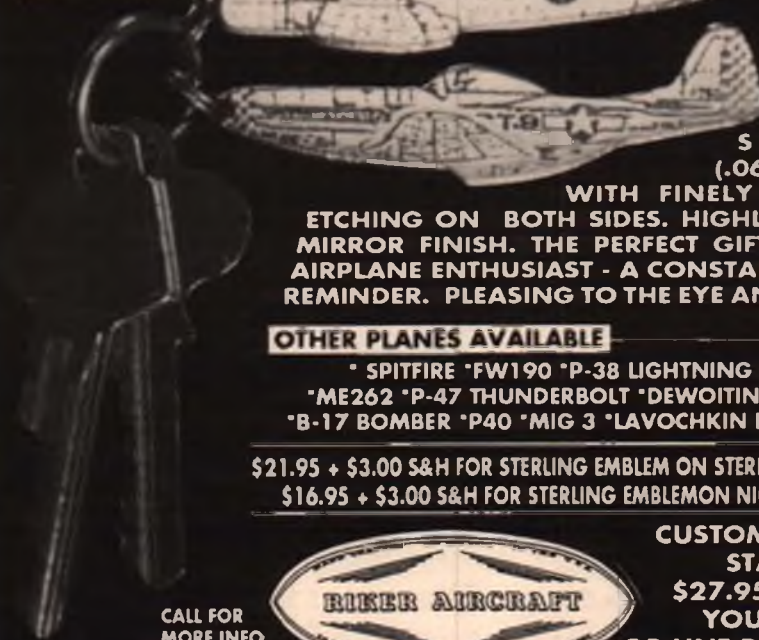
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TRICKLE CHARGERS ARE... USEFUL!

Francis does an about-face for the second time on the same subject. Together, this month's column and the ones in April '93 and December '92 present everything you could possibly want to know about trickle charging.

In the April '93 *Model Builder* the headline for this column was just the opposite of the above. I knew then that I was sticking my neck out; it livens things up. On the basis of the information I had (the General Electric Nickel-Cadmium Battery Application Handbook), what I said then was completely true, and my conclusions were justified. But this column is a frequent exercise in humility, as well as a constant source of education for me. I hope some of you learn half as much from it as I do!

In response to my forget-trickle-charging position in the April issue, I received a phone call and then a follow-up letter from Albert Tejera, president of Tejera Microsystems Engineering, Inc., P.O. Box 340608, Tampa, FL 33694; (813) 968-9510. TME makes the "Auto-Trickle Adapter," into which one can plug a number of standard NiCd chargers. It charges the batteries at .1C for 16 hours, then switches to a pulsed trickle at an effective .025C rate. Mr. Tejera said I had correctly quoted G.E., but that I was considering only G.E./Gates, and that other manufacturers do recommend trickle charging. He felt that continuous charging at the .1C standard rate

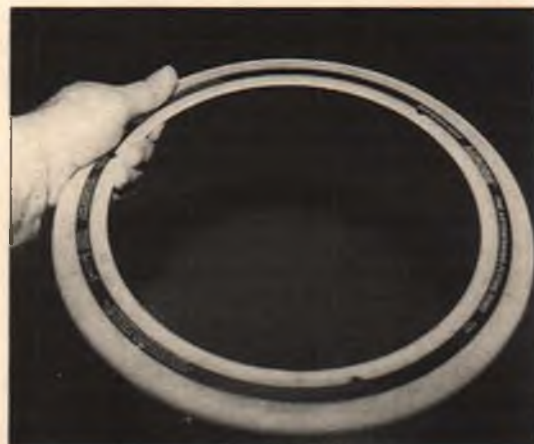
could damage at least some manufacturers' batteries. He sent me a couple sheets from other battery manufacturer's literature, but what he sent didn't clearly prove to me his statements.

Mr. Tejera's call and letter indicated an intelligent, knowledgeable and fair individual, but as a manufacturer of trickle chargers he could be biased; so I did some further investigating before writing this column. I wrote to Jim Smith of Bloomington, Minnesota, who previously told me he had a file of recent NiCd literature from Sanyo, Panasonic, G.E./Gates, Varta and others. Jim graciously and promptly responded to my plea for possible quotes from the various manufacturers on the subject of maximum safe continuous charging rates.

Study showed that Al Tejera had not tried to mislead me; the different manufacturers do make somewhat different recommendations. In the material Jim Smith sent me, I found the following additional information:

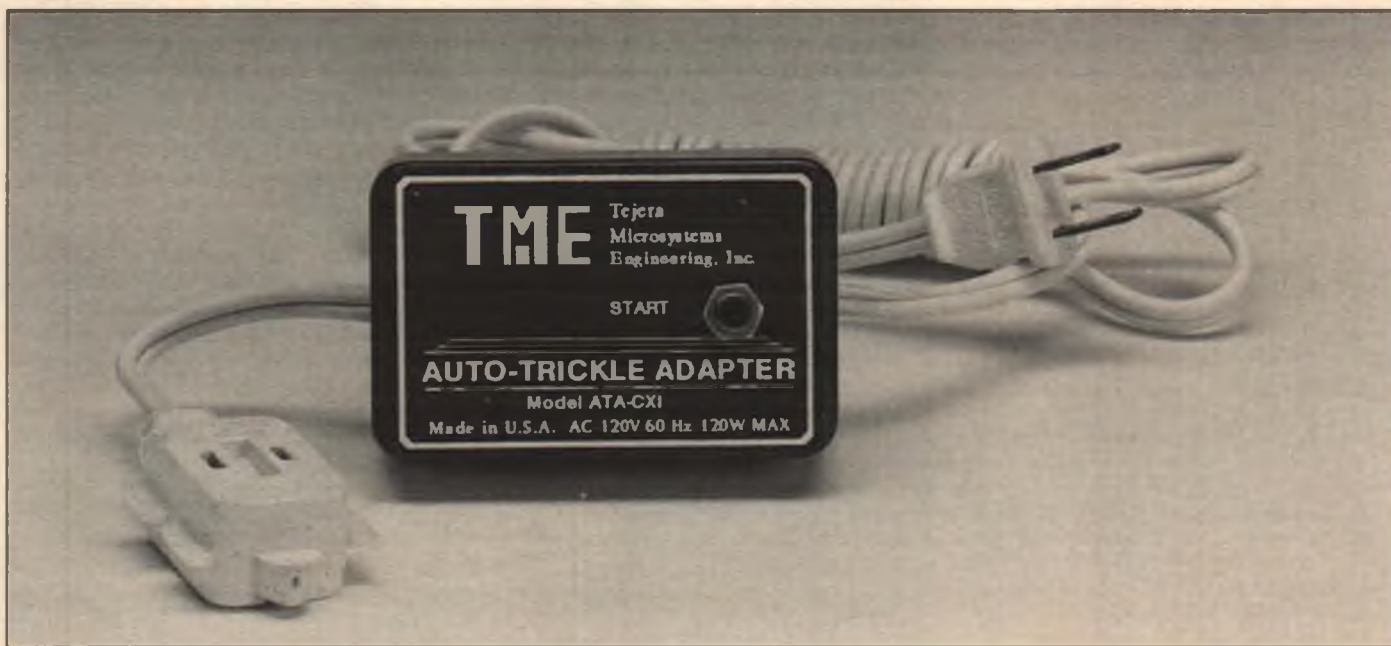
1) Gates says, "Cells can be held on constant overcharge for years."

continued on page 84



A new form of hand-launch glider? It's the "Aerobie," a scientifically designed flying ring that has phenomenal distance-flying abilities—see text.

The Auto-Trickle Adapter from Tejera Microsystems Engineering is a clever device that plugs in between your AC wall outlet and your standard RC system charger. After 16 hours at full charge, it automatically switches to a pulsed output that drops the effective charge rate to C/40—the standard trickle rate. Up to 30 RC system chargers at once can be accommodated by one of these units. Photo courtesy TME.



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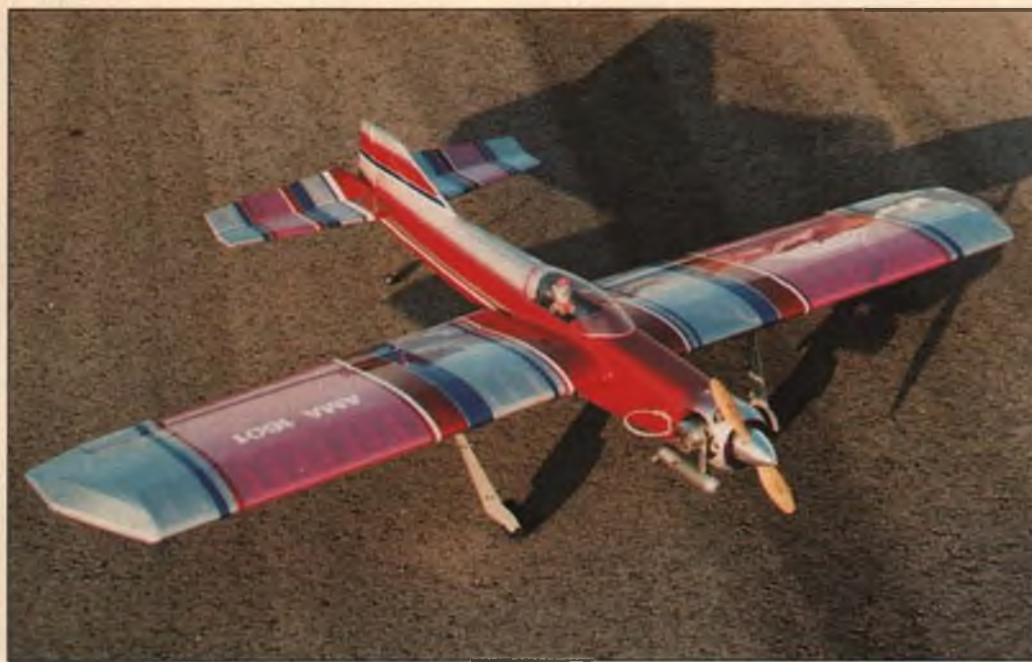
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TWISTER SISTER

The author has done quite well in CL Precision Aerobatics competition with this full-fuselage stunter, based on the popular Sig Twister.

BY JOHN MILLER



Here you see the latest version of the Twister Sister. Changes include an engine cowl (part of a plastic soda bottle), sexy wingtips (more area for better performance at high altitudes), switching to an O.S. .40 FP (ditto), and going to a wing-mounted wire landing gear (saves weight). Sharp-looking model, no?

In the early '60s I never was a top-rated flier, just one of many kids in Southern California who flew "toy airplanes." It was 1984 when I decided to come back to CL Stunt. My first plane this time around was a Top Flite Tutor. It flew well and I used it to polish off a lot of rust that had accumulated over the years.

Later, at the advice of a friend, I built a Sig Super Chipmunk. Now the Chippy is a pretty decent airplane. Powered right and built light, it will perform with the big boys. Unfortunately I lost mine (pilot error) in the fourth contest I entered—June 1987.

I had already started on a Sig Magnum but was nowhere near completion, and I needed a new

more competitive plane.

I just happened to have a Twister in my collection of kits. In a few weeks the new plane, Twister II, as Ted had named it, was ready to fly. I had a lot of fun and even won a few contests with it. I still have it, in fact, and use it as a backup for the new ship I call Twister Sister.

After a few years of flying the "Fancherized" Twister, as they soon became known, I felt it was time to get back to a full-bodied plane. I was assured by all the local Stunt Gurus that the "full fuselaged stunter" was the only way to go; that even though I was doing OK in Intermediate, to do well in Advanced I would have to make the switch. So in March of 1991 I sat down and drew the first sketches of my new ship.

I wasn't surprised by what came out. Years ago as a teenager the thought of a stringered-fuselage stunter had intrigued me. I also wasn't surprised to see the familiar Twister wing because I knew how easy it is to build. The moments came from the earlier modified Twister and the horizontal stab had the same shape.

I'd replaced the Fox .35 on the original Twister II with K&B's .28 Sportster after experimenting with a .20 Sportster converted to diesel. The diesel has some promise, but the .20 didn't have quite enough power. The .28 with the Davis diesel head runs almost like a piped engine, hardly varying in speed throughout the entire pattern. Naturally the new plane was designed around this same engine.

I took it to the Willow Grove, Illinois contest in May. It was blowing pretty hard and I only had about 10 flights on the plane, so I flew the profile Twister II instead. I got 1st in class, only because I didn't crash in the wind.

I next took it to Sig's big contest in Iowa and dorked it in on a wingover—pilot error again. The damage wasn't bad and was easily repaired once I got home. I also added about 1-1/2 inches to the nose to correct a slight tail-heaviness. The next contest was

ship fast. It was then that I received the August issue of *Model Aviation* and of course turned right to Ted Fancher's column, "Control Line Aerobatics." There at the top of the page was a real slick-looking plane, obviously a stunter, and underneath was a picture of the Sig Twister. I was familiar with the Twister; I had flown against them several times, and they had flown pretty well except for a tendency to "bobble" in hard maneuvers. I realized that Ted had modernized the Twister into a much



This photo illustrates the Twister Sister's ancestry. In the background is a Twister II, otherwise known as a "Fancherized" Twister; it's a Sig Twister kit with modifications as outlined by CL Stunt legend Ted Fancher. In the foreground is the author's prototype Twister Sister, built per the plans presented here. Power is a K&B .28 Sportster with a Davis diesel conversion head.

at Peoria; everything went well and the new plane chalked up its first win in Intermediate.

I moved to Salt Lake City, Utah last fall and am experiencing the effects of high altitude (nearly a mile high), so the drawing shows a slightly stretched wing for better high-altitude maneuvering. The local pilots swear that the trick is to lower the wing loading with more area. At lower altitudes, their planes still fly very well.

NOTES ON CONSTRUCTION

There are a few rules to follow when building competition airframes.

Rule #1: Build it light.

Rule #2: Build it only as strong as it has to be.

Rule #3: Build it straight. A straight airplane will usually fly well even if it's a bit heavy, but a crooked, light airplane will never fly right.

Looks plenty cold out there! John Miller with his Twister Sister at the new Jordan River Model Port, near Salt Lake City, Utah.



Start by reading and studying the plans very carefully, then choosing materials that are appropriate for the intended job. Light, straight balsa can be used in areas where the main concern is shape. For areas that must carry a load or are subjected to torsion, slightly harder, stronger balsa should be used. Lite-ply is not much stronger than balsa, in my opinion, so I use balsa. Where I use plywood, it is birch aircraft plywood. Carbon fiber strips, though not called out on the plans, can do much to strengthen areas such as wing spars or the fuselage longerons.

WING

There are two ways to build the wing. You can either purchase a Sig Twister kit and use the wing (you will have to make two ribs, all of the half-ribs, and modify the flaps, but it will save some time), or build from scratch. Either will work well, but you have a better chance of having a lighter finished piece by using your own selected wood and parts.

The wing is built in halves. Start by pinning down the bottom wing spar over the plans. Now set the ribs in their places; remember that the center ribs are different. Set the top spar in place and use scrap pieces of balsa to jig up the 1/4 square balsa trailing edge. Keep it straight! Tack glue everything together with thin CA. Check again to make sure everything is straight, then finish gluing all the joints with CA.

Set the top 1/16x1 trailing edge sheet in place and just tack it

down. Glue the 1/2-inch square leading edge permanently in place. Don't use anything but perfectly straight leading edge stock, as we don't want any warping stresses built in. Glue the top half-ribs in place.

When dry, carefully remove the wing from the plans. Lay it upside down and tack-glue the bottom 1/16x1 trailing edge sheet in place. Glue the bottom half-ribs in place, lining them up with the top ones. Carefully turn the wing panel so you can flow CA into the trailing edge sheeting/rib joints, being careful not to warp the panel. Set this wing half aside and build the other half in the same manner.

When joining the wing halves, scarf joints (angled) are probably stronger but I've always used butt joints on the spars and leading and trailing edges. I usually back it up with 1/16 plywood or 1/8 balsa doublers. Use the method of your choice, but make sure the wing is straight.

Install the 1/4-square balsa supports for the plywood bellcrank mount with slow CA or epoxy; make sure they line up flat and level. Install the 1/8-inch plywood bellcrank mount with epoxy and let it dry.

Set up your leadouts, and bolt your bellcrank of choice in place. (I've used the large plastic Sig bellcranks with good results.) Bend the short flap pushrod from 3/32-inch wire, making sure that the flaps are centered when the bellcrank is at the neutral position. Secure the pushrod with a wheel collar if you're using a plastic bellcrank, or solder a

continued on page 73

PAT'S BIG ADVENTURE

Columnist Forrey recounts his recent experiences in teaching a beginner how to fly an RC sailplane.

A few weeks ago I got a phone call from Pat McDonell, Editor of *Western Outdoor News*. For those unfamiliar with *WON*, it is a widely read weekly tabloid-style newspaper devoted to fishing and hunting in California and Baja. McDonell and I were once neighbors in my childhood days in Rustic Canyon, California. We weren't close neighbors because we lived a half-mile apart, and we weren't close friends because we went to different schools and were a couple of years apart in age. But we did have a mutual friend, and it was through this friend that Pat and I first became acquainted. Now, some 30 years later, our paths have crossed again and we've become reacquainted.

Getting back to the phone call, Pat said he wanted to learn how to fly RC gliders, and that I had been recommended as an instructor by *Model Builder* Production Manager Bill Rice, former Editor of *WON* from 1964 to 1980.

Well, I have to admit that I felt honored. You see, in addition to flying RC sailplanes and electric motorgliders, I also love to fish. I'm pretty good at both fresh and saltwater fishing, if I do say so myself, and I love to read about fishing in general. I've been reading *WON* for about three years and have always had a lot of respect for the tremendous amount of reporting and editing that goes into it each week.

It didn't take long (two seconds isn't long, is it?) for me to agree to help out. I began by asking what, if anything, Pat had to fly. He replied that he owned "some gas-powered RC plane" that he'd tried to fly awhile back, but didn't have much success. He was unable to tell me what the plane was called. I suggested that he buy a Thunder Tiger Explorer 2M ARF sailplane, which is the same ship that gave Bill Rice his intro to RC flying (see February '93 *MB*).

A day or two later, we met at a local Hobby Shack store and picked out the plane. Pat said he already owned a radio (brand name unknown to him), so I didn't encourage him to buy another. This turned out later to be a big mistake, but you know what they say about hindsight!

Just two days later, Pat was on the phone with me at work. I assumed he was calling to ask questions about assembling the model. Wrong! He said he was ready to fly it! He wanted to know if we could take it out the next day!

We agreed to meet at a cliff overlooking



Photographed at Back Bay in Newport Harbor, a popular Southern California slope site, is Pat McDonell, Editor of *Western Outdoor News*, with the Explorer 2M sailplane he is learning to fly under our columnist's tutelage. As described in text, their first time out was a comedy of errors and serves as a lesson in what shortcuts not to take!

the Back Bay of nearby Newport Harbor in the early afternoon. "Back Bay," as it is called, is a popular place for slope fliers. However, when we arrived, we were pleased to see only one other flier, and he was just leaving. We had the whole place to ourselves.

We began to set up our gear, and that's when the problems started surfacing. The first problem popped up when we checked the radio prior to assembling the model. The aftermarket, set-screw type pushrod connectors were allowing the pushrod to resist the motion of the servo arm. The problem was compounded by the fact that neither of us had the proper Allen wrench or even an

improper pair of pliers to tighten the set screw. The problem was solved by jamming my pocketknife's blade point into the socket and torquing down the screw with as much pressure as could be brought to bear.

Another problem was discovered when I noticed that the receiver antenna wasn't hanging out of the fuselage anywhere, and I couldn't see it inside the fuselage either. Where was it? When the receiver was pulled out of its hiding place, the antenna was discovered to be only about 6 inches long! Obviously it didn't come this way from the factory; it must have been broken in a crash of its prior home aircraft.

By this time a few other fliers had gath-

ered, so we asked around for some scrap wire to use as an antenna. No such luck. Pat eventually found an 18-inch piece of 14 or 16 gauge electrical wire. It wasn't long enough, and it was too heavy to be stock replacement stuff, but it might do in a pinch.

Lacking any way to solder the wire ends, we tried twisting them together tightly. Didn't look good. There was a way for it to unravel if rubbed just the right way by the pushrods. Still, we kept on going with the preflight check.

Next, we tested to see if the rudder and elevator were moving the right way. Direction was OK, but there wasn't enough rudder or elevator throw. The clevises were moved to the second-from-the-inside hole on the control horn on both the rudder and the elevator.

Now it was radio range check time. Because of the too-short receiver antenna wire, I elected not to do the range check with the transmitter antenna collapsed. I figured one short antenna was bad enough, let's see if we have enough "safe" range at maximum available antenna. With the transmitter antenna at full length, I started the long walk down the edge of the cliff. Surprise! We still had solid reception at the end of the useable cliff face.

The one remaining problem was the transmitter configuration, something we couldn't change. It was a two-stick, Mode 1, low-budget rig, and I have always been a Mode 2, single-stick pilot. From previous two-stick experiences, I knew I wouldn't be a smooth flier and probably not a good instructor either. Also, I had heard several stories about reception problems with the early models of this particular radio, and since Pat didn't know how old it was, I wasn't at all confident of its reliability, and told him so. He wasn't overly concerned, so we elected to fly it anyway.

Next came the test flights. Behind the cliff was a large vacant lot covered with tall, soft, lush green grass . . . perfect for proof-of-trim test glides. The CG checked out a little on the forward side at about 25 percent, but it was still flyable. Trims were adjusted for neutral rudder and elevator. Zero hour had arrived!

Facing the wind, I gave the Explorer a gentle toss. Rudder command seemed weak, but the elevator was just fine. We moved the rudder clevis to the inside (maximum throw) control horn hole.

The next test glide was perfect, so it was time for the "Are we mice or men?" acid test. We stepped up to the cliff and Pat launched the model while I kept my hands on the sticks to (hopefully) save the model, should that cobbled-together radio begin to act up. It didn't, and the Explorer was soon climbing in the breeze. Many laps later, Pat gave it a try and, for a total novice, was quite successful at making some turns. Naturally, there were times when he got into trouble and I had to take over.

To me, flying a two-stick radio is a lot like trying to rub your tummy in a circular motion while patting your head up and down. It's damned hard to keep from crossing your

motor nerve signals! Neither of us was very smooth or coordinated at the controls, but we did manage to stay airborne for nearly 20 minutes.

We even did three consecutive loops to see if the Explorer had straight wings (it did). All three were in the same vertical plane with only a slight roll-off detected when the glider got too slow on the third loop. It was actually flying very well. But then something went wrong.

On one pass, Pat was fairly low and had

strain and broke clean off. I told Pat it was a simple repair, and not to be discouraged. As crashes go, this was nothing!

With an admonishment to wash out the receiver and servos with fresh water as soon as he got home, followed by a thorough drying with a hair dryer, we said good-bye till next time.

A few days later, Pat called again to say the Explorer was all repaired and ready to go. I wanted to loan him a four-channel radio to replace the soaked two-channel rig and to



■ LEFT: The Explorer 2M is a sturdy bird ideally suited for basic flight instruction. The wing is held on with rubber bands so that it will pop off in a crash—a feature that proved its worth on Pat's model on at least one occasion. ■ BELOW LEFT: Avoiding the pitfalls that inexperience invariably throws at you is one of the secrets to success in model soaring. Would you have known this radio receiver was not full length and a probable cause for disaster? Would you have brought an Allen wrench or pliers to tighten loose pushrod connectors, thus avoiding the use of a pocketknife? If it was your first time out, probably not! ■ BELOW RIGHT: This is the end result of a 100-foot out-of-control crash dive from cliff height, and the subsequent ham-handed retrieve of the submerged fuselage in a foot of salt water! Minimal damage to the fuselage, no damage at all to the wing or stab.



the model in a slight turn that looked like it might intersect the face of the cliff. I took over. . . or at least I *tried* to take over. The plane wasn't responding to rudder or elevator commands, and it was starting a sickening death-spiral. Speed built up fast as it disappeared from view below the cliff's edge, accelerating all the way! No way was the ship going to survive, I thought.

We heard a faint "whump" a couple of seconds later. When we peered over the cliff's edge, we saw the Explorer resting in three pieces—wing, stabs, fuselage—in about a foot of water. *Salt* water. From our vantage point, it appeared to be relatively free of damage. Sure enough, after a brief hike, we found only a broken glue joint at the stab junction and a popped canopy! The rubber bands holding the wing had done their job and let go; the water had saved the wing from impact damage. The wing was actually in perfect shape.

The biggest damage was done when Pat tried lifting the submerged, water-filled fuselage out of the water by the tail end. Needless to say, the balsa tail cone couldn't take the

introduce him to single-stick control. He was agreeable to the idea, and we set up another flying day.

When that day arrived, I learned that the receiver had been given the fresh water treatment a day *after* the dunking and that the servos had not been washed out at all. Hmmm, probable corrosion damage. But Pat assured me the servos were working, so we proceeded to swap out the receiver. Luckily the two radios came from the same source, even though the brand names were different, so the servos plugged right into the four-channel AM receiver. They did appear to work properly, so off we went to fly once again.

This time the wind was not as favorable. Tufts of foxtail seeds thrown into the air at cliffside went up weakly and trailed off at a 45-degree angle to the slope. There was enough wind for the Explorer to fly . . . barely. We test glided over the tall grass one more time just to see if Pat's repairs had changed anything. They hadn't, so over the cliff it went!

Upwind legs were slow relative to the



Three new publications that RC soaring buffs will want to add to their bookshelves. From left: *SoarTech* #9, compiled by Herk Stokely; *Model Sailplanes Without Myth or Magic*, by Tony Upso; and *M.A.R.C.S. National Sailplane Symposium*, edited and published by Allan Scidmore. Text has details.

ground and lift was only good enough to eek out about 10 feet of altitude. However, downwind passes gave up a lot of the hard-won altitude and it looked like the Explorer would dip below the cliff. It was time to bring her in. I circled out away from the cliff and turned back into it with a mere 3 feet to spare.

The final approach looked like a gentle one before the plane disappeared behind a small clump of weeds. When we found it, a faint whirring sound was coming from inside the fuselage. I've heard the sound of a servo with stripped gears before; this was the same sound, confirmed by the fact that full left rudder command made the whirring sound stop, while neutral stick made it start up again. Yet the landing didn't seem rough enough to cause gear damage.

Well, that was all for Day Two. Back to the local Hobby Shack store, where we picked out two new servos and a switch harness compatible with the NiCd pack from my old radio. The Explorer will fly again, and hopefully all our problems will be over!

Let this story be a lesson to all beginners and would-be instructors. If you are going

to fly with equipment of questionable airworthiness, be prepared for the worst. It's best not to take chances! When it comes time to buy a radio system, buy quality, not just the lowest price. And do your instructor a favor, buy a Mode 2 four-channel system with NiCd batteries. Ninety percent of the radios sold for aircraft are Mode 2—so are 90 percent of the fliers!

FOR THE SOARING BOOKSHELF

•*SoarTech* #9

I wrote about this latest in Herk Stokely's series of technical journals in my June column. Suffice to say that this highly regarded publication is loaded with great reading and valuable information. Contact Herk at *Soartech Journal*, 1504 N. Horseshoe Circle, Virginia Beach, VA 23451.

•*Model Sailplanes Without Myth or Magic*

Tony Upso is the author of this very unusual work. Upso describes himself as an "experienced aeronautical engineer" who has written a book with no graphs, tables or diagrams in such a way that most will comprehend. Interestingly, he challenges the validity of several of the "advancements" in

sailplane design and construction that have become popular in recent years. Quoting Upso: "...When you're through, you may not understand it all, but I guarantee that, what you do learn, will be solidly based and you will never forget it!" Good bedtime reading. Send \$18.95 plus \$3 S&H to Beefsteak Mines Ltd., P.O. Box 1645, Jackson, WY 83001; (307) 733-3729.

•*M.A.R.C.S. National Sailplane Symposium*

The transcripts of last year's M.A.R.C.S. Sailplane Symposium are now in print. Editor/Publisher Allan Scidmore says he feels "...that this ranks as one of our best efforts," and I would agree. Titles include: Frequency Analyzers, Similarities of RC and Full Size Gliders, Computer Radios for 1992, Electric Sailplanes, Modern Sailplane Construction for the Common Man, Sailplane Instrumentation and Telemetry, The Cross Country Sailplane, Meteorology for Model Sailplane Fliers, and more. Write to Allan K. Scidmore, 5013 Dorsett Dr., Madison, WI 53711. Send \$12 plus \$3 S&H (\$6 S&H outside the U.S.).

I welcome phone calls if you need sailplane related advice or help; (909) 245-1702 evenings between 6:30 and 9:30 p.m. **MB**

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THE 1922 MARTIN MO-1

BY DAVE LINSTRUM

Everyone who has seen the movie "Top Gun" knows the current status of U.S. Naval aviation, with hot pilots making catapult-assisted takeoffs and arrested landings on the decks of nuclear-powered carriers. The Martin MO-1 goes back to the very early days of Naval aviation. Back then, the "Top Gun" was Naval artillery on a battleship (the dreadnought of WWI), and these ships needed fleet spotter aircraft for operating/scouting over the horizon.

In response to a Navy specification for such observers, the Glenn L. Martin Company pro-

duced the Martin MO-1 in 1922. It served as a landplane and also was fitted with floats. In 1924, it served on the first carrier Langley. Navy archive photos show it landing on the deck! There were Navy hero pilots in those days, too!

ideal for outdoor hand-launch flying, but the gear is too short for the indoor 10-second bonus with Rise-Off-Ground launch.

The MO-1 Peanut is easy to build. The simple details like the exhausts, bombsight, machine gun and cockpit add a lot to its looks. On this model, the cockpit, connecting catwalk and gun pit are simulated with black paper, as are the windows in the access doors just below the wing.

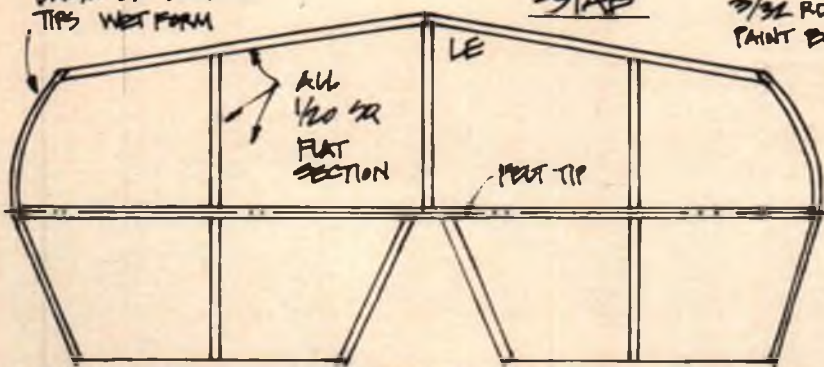
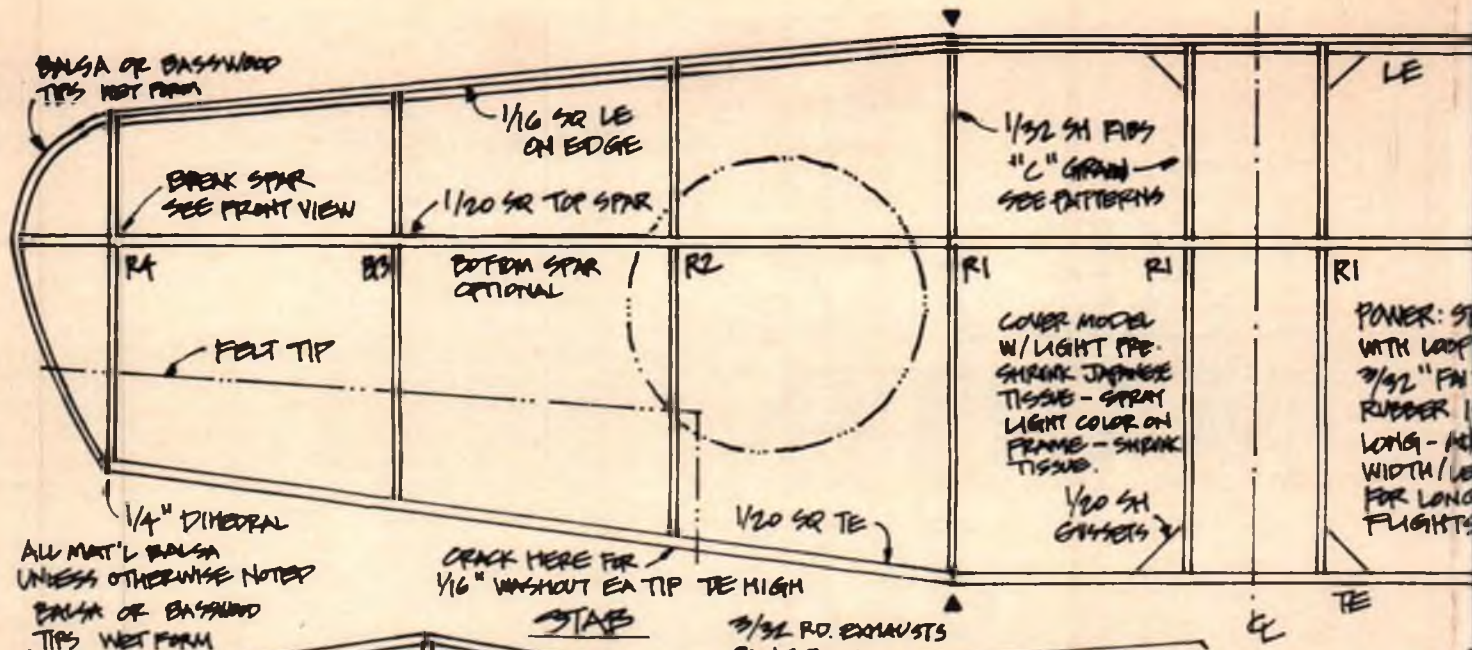
You should not attempt this Peanut unless you have some solid experience with stick-and-tissue models. We suggest you



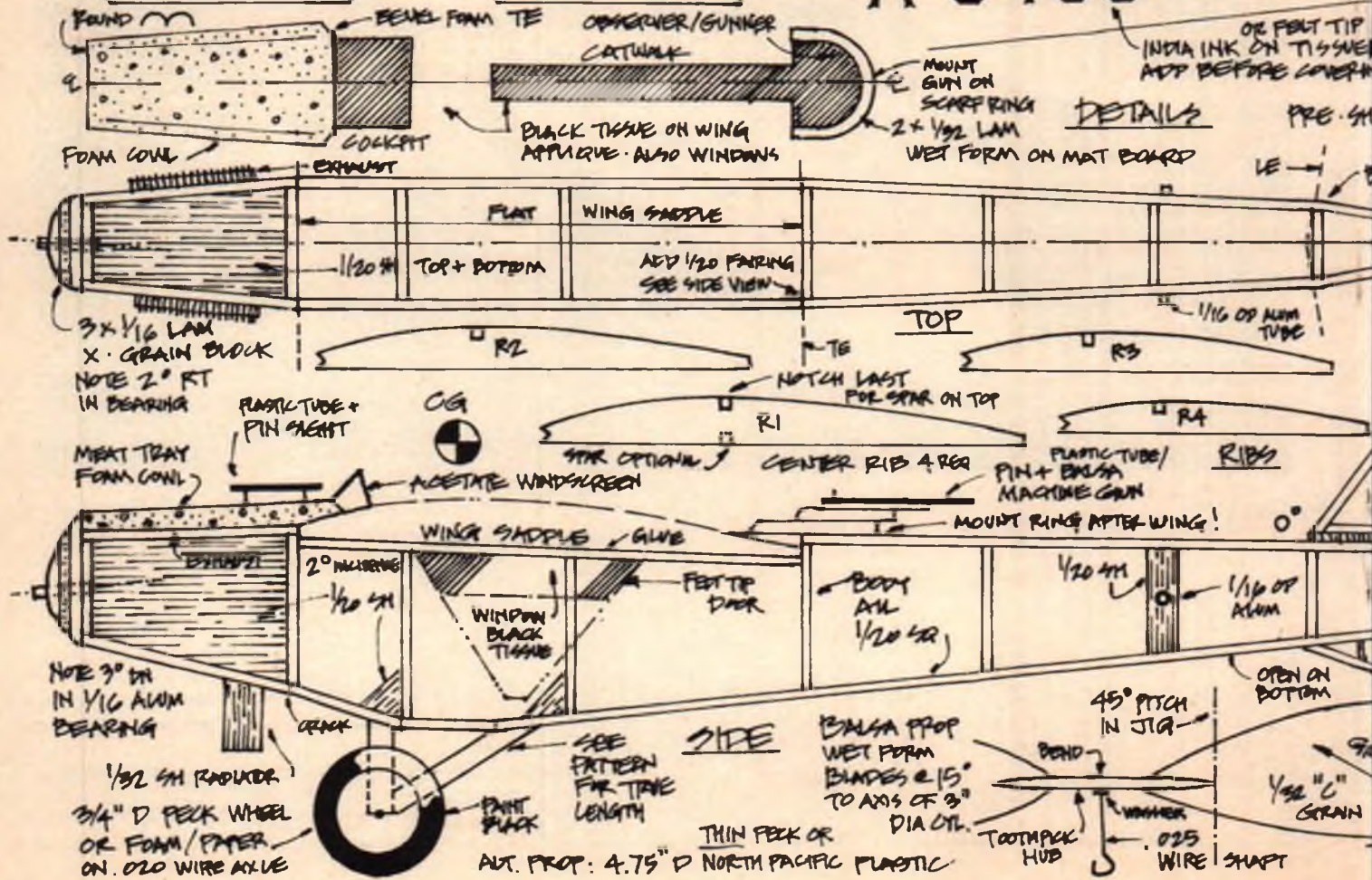
duced the Martin MO-1 in 1922. It served as a landplane and also was fitted with floats. In 1924, it served on the first carrier Langley. Navy archive photos show it landing on the deck! There were Navy hero pilots in those days, too!

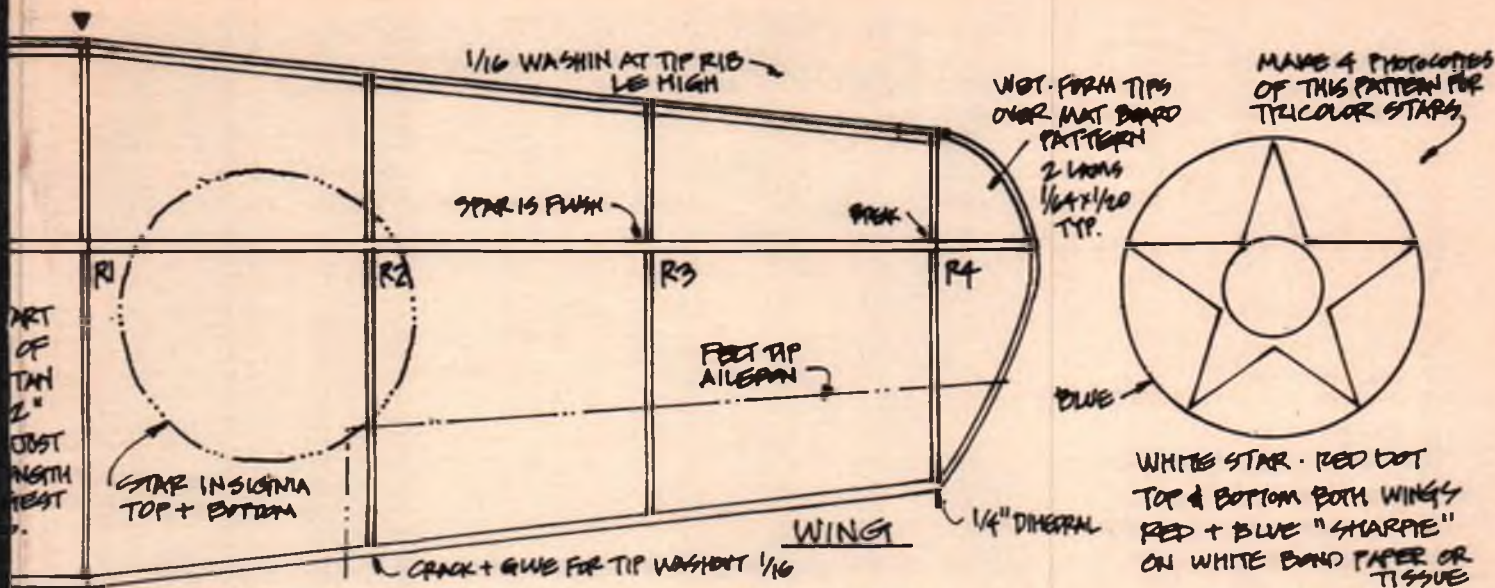
This historic aircraft makes a good choice for Peanut Scale, as it is very colorful (silver and chrome yellow, with big wing stars and tri-color rudder) and has a big barn-door wing. It is

develop your skills by first building the Peck R.O.G., Peck Sky Bunny and one of the simple Peck Peanut series, perhaps a Nesmith Cougar or Pietenpol Air Camper. These are available by mail order—consult the Peck-Polymers catalog. At the same time, you may also wish to order the materials to build this model, such as 1/20 square and 1/32 and 1/20 sheet balsa, plastic prop, shaft, rubber, rubber lube and white Japanese



A-6455





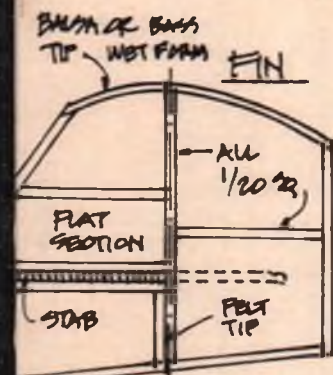
RED + BLUE "SHARPE" ON TISSUE OR BOND



R W B TRICOLOR

TRUNK TISSUE COVER ENTIRE MODEL

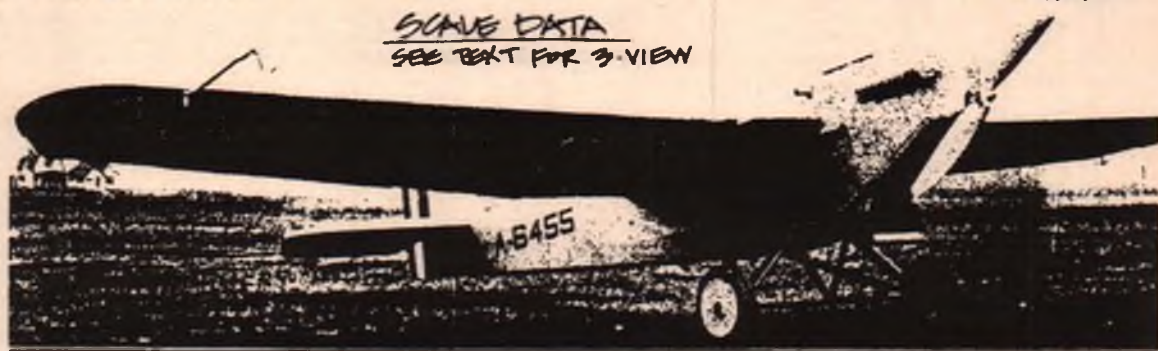
TRUNK + CYA GLUE



1/64 PLY SKID



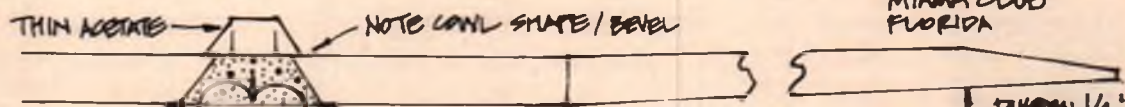
TRUNK TISSUE COVER ENTIRE MODEL



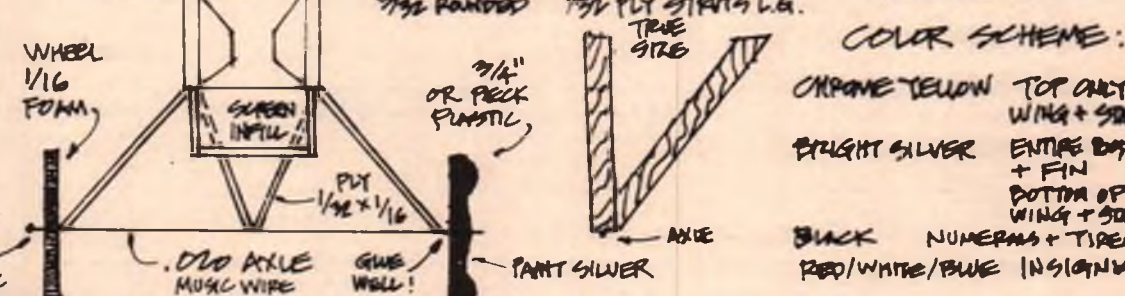
NOTE WINDOW UNDER WING!



PHOTO & DETAILS: JANE'S - 3. VIEW / NATIONAL ARCHIVES COURTESY DR. JOHN B. MARTIN JR. MIAMI CLUB FLORIDA



FRONT



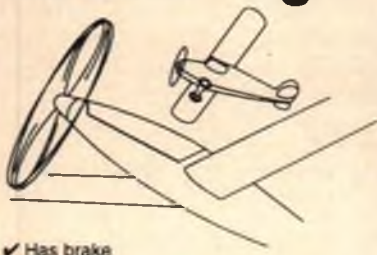
WHEEL 1/16 FORM

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For a scale model, the MO-1 is ridiculously simple—one of the reasons it's been so popular with the CL Navy Carrier folks over the years. It's practically all straight lines, the only exceptions being the curved tips, which are laminated from balsa or basswood—technique explained in text. Model in the photos was built by Sidney Gilbert, of Sarasota, Florida.

tissue. You will have to apply your own spray colors to match the model colors.

Take your magazine to a local copy shop and make two 11x17-inch photocopies—one to build on and the other for patterns and decoration. See plan for notes on pattern use. Tape your building plan to a smooth, flat board (a scrap of artist's carpenter's glue, but a good gap-filling CA glue is fine. When dry, separate the sides and box up the fuselage over the top view. We use a 4-inch drafting triangle to align the sides while they are pinned upside down over the plan, as crosspieces are added.

Begin by building the fuselage sides one atop the other—note the sheet parts. We prefer Titebond or Elmer's carpenter's glue, but a good gap-filling CA glue is fine. When dry, separate the sides and box up the fuselage over the top view. We use a 4-inch drafting triangle to align the sides while they are pinned upside down over the plan, as crosspieces are added.

Wing and tail surfaces are simple, but have curved tips which are laminated on mat board forms from two 1/64x1/20 balsa or basswood strips. Soak the strips for five minutes in very hot water, blot them dry on a paper towel, then apply a thick coat of Titebond to one strip and add the other. Now tape these sandwiched strips to one end of the overlength form, pulling the strips around the curve, and tape the end. Then microwave on high for one minute. Trim to size and install. Voila—your surfaces have rounded tips!

If you choose to use a plastic prop, you can go ahead and make the laminated nose plug with a 1/16-inch O.D. aluminum bearing (note built-in angles). If you fly indoor, you may choose to build a balsa fan. Note the grain on the blades, which are soaked in very hot water, then formed on a 3-inch diameter cylinder at 15 degrees left of axis (try a soda bottle as a form). Let them dry overnight. Make the prop hub from a toothpick and .025 wire, glued well with an L-bend at the front. Make up a pitch jig with a vertical upright post and glue a shaped

blade to the toothpick (cut a vee notch in the blade) so that the pitch is exactly 45 degrees as shown. Then rotate the hub and attach the opposite blade. Insert the shaft into the bearing, using a brass washer at the front, and bend the rubber hook.

Pre-shrink and color the tissue on a frame big enough to hold enough paper to cover the model. First spray the tissue with water, let dry, then spray your color, either from an airbrush or aerosol can. We found that a misted coat of Testor's chrome silver (for plastic display models) made a fine color. Don't apply too much paint or the model will be too heavy to fly well. Use thinned white glue to affix the tissue to the framework. Apply all details and decoration—see plan notes for technique.

Make up a test motor of 3/32 FAI tan rubber in about a 12-inch loop—you can add length after initial trimming. Check the center of gravity on the plan and balance the model under the wingtips—add weight to the nose or tail if necessary. Check the model for warps (note the tip washout and right wing washin). For the initial flight, put in about 500 turns on the motor. The model should climb to the right in a loose circle. If it stalls, add down or right thrust with shims behind the nose block. Be sure the nose plug is a tight fit so that thrust adjustments are held. If the model spins in to the right, add a paper or balsa tab about 1/4-inch wide and 2 inches long to the trailing edge of the right wing, and bend it down to keep the wing up in a turn.

If you fly outdoors, fly only on calm days. Ground turbulence in wind will ruin a good flight.

We hope you enjoy building and flying this historic Navy aircraft. Control line fliers love it for the Navy Carrier event, where it has excellent flying qualities. You can pretend to be a "Top Gun of the Twenties" and fly your MO-1 on a search for the enemy fleet lurking over the horizon! **MB**

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The Kalt Enforcer ZR from Horizon

Model Builder's former helicopter columnist checks out Kalt's newest offering, a high-performance heli that's also one of the least expensive on the market.

BY DICK GROSSMAN



Long and lean is the new Kalt Enforcer ZR look. Tail boom has been stretched 1-1/2 inches, rotor diameter is increased by 3 inches.

The new decals are a dead give-away, but except for that, it's hard to tell whether the new Kalt Enforcer ZR is bigger, or just closer. It is bigger—3 inches longer in rotor span than the standard Enforcer, with a 1-1/2 inch longer tail boom. There are plenty of other changes too, but mostly they're hidden away in the mechanics. You'll get to see them while you're building, but that's it.

This is the first Enforcer of any size that I've built. I was amazed at the quality of this kit—especially considering that this is one of the least expensive helicopters on the market.

Most of my building was done at Nick Nicholas's shop, Vortex RC Helicopters, in Costa Mesa, California. Nick has built over 50

Enforcers, so it was easy for him to see if I was doing anything stupid. He also quickly picked up on every one of the changes that Kalt has made in the ZR.

One unique aspect of the Enforcer is its modular design. The transmission is one complete module, as is the drive train, the sideframes and landing gear, and the radio and servo compartment. All of the modules are attached in such a way that they can be removed individually. It takes no time at all to remove the engine, change a gear, or even replace a sideframe—things we frequently have to do on our helicopters that can quickly become a nightmare.

My construction of the Enforcer ZR started with installing the

helicopter world

engine (the new Webra .32 Redhead—more about that later) and the rest of the drive train. The one-piece clutch is an unusual configuration (have you ever seen a Kalt clutch that wasn't?) that bolts into an aluminum sleeve in the cooling fan. The aluminum clutch bell is better than well-made—it's as nice as any of those \$70 aftermarket clutches—and it comes with the clutch lining already glued in.

The cooling fan is molded nylon with an aluminum base. No warps or runout; and it's sturdier than plastic. The end of the drive train is the lightweight plastic starter cone with a protective aluminum cap. You won't see that part in the pictures, however, because I'm using the Vortex one-way bearing start cone which is made especially for the Enforcer. I use that type of start system on all of my helicopters.

After the drive train was assembled, I gave the clutch bell a spin. No drag, no runout, no wobble! How often do you see that? In fact, don't even bother balancing or dial indicating anything in the drive train—it doesn't need it.

The transmission case has been remolded to accommodate the new larger, sealed bearings that have been added on both the main shaft and tail output drive shaft. In addition, collars have been added to the main shaft at both ends of the transmission case to prevent any up-and-down movement of the main gear. It's important to maintain an even mesh with the output pinion gear and the main gear. Until recently, that main gear was plastic and had an annoying tendency to shed teeth. It has now been replaced with one made of nylon, and has thicker beveled teeth. I know that Enforcer owners have been waiting a long time for that replacement gear!

The gear train and tail drive on the Enforcer are the smoothest I've seen on any .30 size heli, except maybe the TSK Five-Star that James Wang reviewed earlier. Try this little trick. Spin the rotor head on an Enforcer clockwise. You will see that the tail rotor will turn just a little, too. The reason is that there is so little friction in the tail drive and tail rotor gearbox that even the minute amount of drag in the autorotation clutch is enough to move the tail rotor. Try that on another helicopter—the tail rotor probably won't turn.

The entire tail drive, front to back, has been beefed up. A larger 2mm tail drive wire is being used and a fourth wire guide has been added. The Enforcer tail drive wire, as you may know, is looped at each end to fit slots in the front and rear drive coupling. This eliminates the need to have set screws at one end—a weak link in any heli.

Kalt has substituted metal balls for the plastic ones on the swashplate, mixer and blade grips. However, they didn't change the ones on the flybar seesaw, tail rotor bellcrank, aileron lever, or the little ones on the tail blade holders. I would like to see all of the plastic balls gone. It's hard to tell which are which because the metal balls are black like the plastic ones, and molded right into the plastic. (The way to tell is that the metal balls have a small flat on the tip.) As they come, they're a little rough and slightly oversize. I used Dremel polishing compound and a paper towel to polish them. It only took about two minutes per ball, and the ball links fit very smoothly when I was done.

All of the mixer arms are now ball bearing supported on both sides. In fact, there are a total of 36 bearings in the ZR. However, the pitch and roll lever arms still have brass bushings, and Nick Nicholas suggested I put bearings in those arms as well. It just so



A closer look at the new canopy color scheme plus the special Enforcer muffler.

happens that he has a set made up with the six bearings needed, which he sells through Vortex RC Helicopters. The rotor head has two open radial bearings on each side. If you're going to run blades that are heavier than stock, you might want a set of thrust bearings as well. These are available as an aftermarket item from Horizon Hobby Distributors. By the way, this isn't a rap on the Enforcer. The bearings that are supplied with the ZR have been put in the most strategic places; but many of us don't mind spending the extra money to get that helicopter extra "tight."

A minor complaint that Enforcer owners had in the past concerned the landing gear struts. They used to be attached with self-tapping screws, which were easily stripped if you had a hard landing. On Enforcer kits made after November 1991, 18mm cap screws are used with threaded brass inserts in the cross members.

They're much stronger, but remember that old adage about helicopters. If you make one part so strong that it won't break, another part will. In the past, those screws stripping out sometimes saved the mainframes.

A nice touch worth mentioning: the landing gear skids are hollow aluminum tubes, and the inside of the hole at each end is beveled, so that the little nylon end caps slide right in. It seems like such a little thing—unless you've ever tried to insert those end caps where the edge was sharp and kept shaving off material as you pushed it in; and the CA you had applied to the end cap smeared all over your fingers... and then dried before you were done. It's happened to you, hasn't it?

The new main rotor blade grips are now one piece; they're thicker, stronger, and also wider to accept thicker rotor blade roots. What's really nice is how easy it is to change the flex plates. Unscrew three bolts, put in a new plate, put back the three bolts—that's it.

Somebody figured out that if you install an extra set of those flex plates on the bottom of the blade grips, you can restrict the downward flapping of the blades, and reduce boom strikes. These now come with the kit and are called "boom strike

continued on page 76

KALT ENFORCER ZR

TYPE	Trainer through aerobatics.
ENGINE SIZE30 heli.
ROTOR SPAN	49-1/2 in.
ROTOR DISC AREA	1924 sq. in.
TOTAL WEIGHT	6 lbs. 2 oz.
ROTOR BLADE LENGTH/WEIGHT	530mm/82 gr.
OVERALL LENGTH	42-1/2 in.
RADIO	Heli system, minimum five channels.
SUGGESTED RETAIL	\$479.95.

DISTRIBUTOR: Horizon Hobby Distributors,
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The JR PCM-10S Heli Radio

PART III • BY JAMES WANG

This month we will conclude our three-part review of the JR PCM-10S helicopter radio by discussing the five program mix functions. These are shown in the four comprehensive setup data sheets that you can get by sending an SASE to the *Model Builder* magazine offices. The data sheets are for the Kalt Excalibur and Kyosho Concept 30 and 60, but with only a bit of fine tuning, will work for almost any RC helicopter on the market.

To begin with, all five mixing functions are automatically activated when either idle-up 1 or idle-up 2 is switched on. The first program mix in the chart mixes "aileron" with the collective stick position. (The screen says aileron, but it really should be called roll cyclic in helicopter jargon—to avoid confusion with the chart, let's stick with aileron.)

As shown in the chart, 3 percent of left aileron is automatically

given at full positive collective stick position, and 7 percent right aileron is given at full negative pitch. When the throttle/collective stick is at the center, no aileron mix is given. The reason for this mix is that when a model helicopter (with a clockwise rotation main rotor) moves into forward flight, the imbalance in aerodynamic forces causes it to veer to the right. The imbalance increases with flight speed, which generally means more throttle/collective stick. The first thing I do after I move into forward flight is activate idle-up 1, and the 3 percent left aileron input automatically keeps the the model flying straight.

The exact percentage of aileron mix will depend on the model; 2 to 5 percent is a good starting value. On my Concept 30, I need 3 percent. The plus or minus sign on the chart depends on your servo type and linkage setup. Just make sure that full positive collective stick gives left mixing, and full negative stick gives right



Here you can see the three-position idle-up switch at the top left front corner. The elevator dual rate switch is on the front face. The hover pitch and hover throttle knobs are on either side of the RF power meter. Text and the data sheets (available from *Model Builder* by sending an SASE) explain the use of both of these knobs.



Len Sabato flying his Kalt Excalibur with the JR PCM-10 at the 1991 U.S. F3C team trials. Len is now the Kalt helicopter product line manager at Horizon Hobby Distributors. He's the guy to talk to at Horizon if you have questions regarding the PCM-10S heli radio.



The new JR NEJ-160 mini gyro is designed with electric helicopters in mind, but our author has tested it on the gas Concept 30 with no problems. It has dual gain settings. The text and program mix 5 on the data sheets explain how to program the PCM-10S to automatically toggle between high and low rate with the idle-up switch.



mixing. We need right mixing for negative stick because in switchless inverted flight, the model will drift to the left.

I use program mix 2 to mix "elevator" (fore/aft cyclic) with the collective pitch stick position. The chart shows that 5 percent of forward cyclic stick is mixed in at full positive collective, and 9 percent aft cyclic at full negative stick. This helps keep the

Side view of the JR PCM-10S transmitter shows the antenna stored in a hole to the upper right of the charge receptacle. Just above the charge receptacle is the control for the display screen contrast. The trim lever on the top is high-end pitch trim. The transmitter has an easy carrying handle. The tail toggle switch at the upper right corner is throttle hold.

model level in upright or inverted forward flight. A hint for checking the direction of mix is to type in a large percentage value first, such as 50 percent, then reduce the value.

Program mixes 3 and 4 are for boosting up the throttle opening by 10 percent when maximum cyclic inputs are given. However, this is only useful when the throttle is not already at full open.

Program mix 5 is for automatically switching the rate gyro from high rate in hover to low rate in forward flight. The Aux 2 channel is used as a dummy only. Instead of Aux 2, you can use any toggle switch channel as a dummy channel. More discussion of the general nature and purpose of using program mix to improve forward flight aerobatics can be found in my April 1991 "Chopper Chatter" column.

Now let's discuss the PCM-10S tail rotor mix. The tail rotor mix values for the Concept 30 are shown in the data sheet. The values I used are given in the box labeled ATS Revo-mix. The first two lines say POS HOV and ZERO, and refer to the stick position at hover and at zero collective pitch (0 percent means full low stick, 100 percent means full high stick). I used a value of 50 percent for HOV, which means my Concept hovers with the throttle/collective stick at around the 50 percent position (half stick). The value of 39 percent for ZERO means my main rotor blade pitch angle is at 0 degrees when the throttle/collective stick is at the 39 percent position.

The HOV position is used for the UP and DN tail rotor mix during the normal pitch curve. The chart shows I use 30 percent up mix and 40 percent down mix; this simply means that when my throttle is above the half stick position, it will start to mix in right tail rotor command automatically, until at full throttle stick, 30 percent right tail rotor will be mixed in. At below half stick, up to 40 percent left tail rotor will be mixed in. The -P value, if used in the NORMAL mode, allows the ATS mix curve to have a slight U-shape. This means that at low collective stick, it increases the tail rotor pitch again. I made -P equal to 0 because I use the



Two self-adhesive rubber grips are included with the PCM-10S system. They can be attached to the back of the transmitter for an even more comfortable grip.

normal mode for hover only.

STNT in the chart merely indicates that idle-up 1 or 2 is on. The +P and -P functions are a bit confusing for the first-time user. At full throttle, the +P controls how much the idle-up tail rotor pitch will vary from the normal mode setting. At the full low throttle/collective position, the -P controls how much the tail rotor pitch will increase as compared to when the main rotor blade is at 0 degrees. The throttle stick position for 0 degrees collective pitch was defined in our ZERO setting box (I used 39 percent).

Yes, this all sounds very confusing. My suggestion is to just type all the values given in the chart into your radio first. Play with the throttle/collective stick for a while, then vary the numbers one at a time and you will soon understand what each one does. The PCM-10S instruction manual on this topic is much better than the older PCM-10 instruction manual. The older manual confuses the reader tremendously.

Two of the most useful knobs on any helicopter radio are the hover pitch trim and hover throttle knobs. These two knobs

allow you to fine-tune the main rotor in hover. Sometimes, when the engine is running rough or the tail is shaking slightly or the humidity and temperature have changed or the wind conditions are changing, tweaking the knobs to increase or reduce the rotor rpm can transform the model from a mediocre flying machine into a smooth and responsive machine. On the data sheets I have circled HOV for positions 1, 2 and 3 in the normal mode throttle and pitch curves. This means that turning these knobs will shift points 1, 2 and 3 up and down simultaneously. If you have only selected point 2, turning the knob will only move point 2. I prefer to select all of the points. To understand this feature, simply go into the normal mode pitch or throttle curve display and watch the curve change on the LCD display as you turn the knob.

(Handy hint: When playing with the PCM-10S programs, it's OK to remove the transmitter RF module. This will save a lot of battery because you will not be transmitting a signal. This is also useful for making adjustments at the flying field, as you will not interfere with other fliers on the same frequency. I have confirmed with JR that doing this will not damage your radio. I have done this with Futaba and Airtronics transmitters also and it does not damage them either.)

If you still have questions regarding programming the JR PCM-10S, give Horizon Hobby Distributors a call. Mr. Len Sabato has recently joined Horizon as the Kalt helicopter program manager. Len has flown RC helicopters for many years, and was a contestant in the 1991 USA FAI F3C team trials. He should be able to answer any of your JR radio questions. Of course, you can still call me at my home, but recently I have been quite busy at work, and I have been

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swamped with calls. The best time to reach me is around 9:00 to 11:00 p.m. East Coast time. I'm usually out flying every evening until about 9:00 p.m.

The pitch curve settings and control settings given here for the Concept 30 and 60 have been thoroughly flight tested. I've had the Concept 60 for two years now; it has logged over 200 flights and four major crashes. After each crash I needed to re-trim the model, but I've found that the curve shapes almost never change. Nowadays, before I fly a new model, I can punch in all the program settings based on previous knowledge, and the new model will fly practically hands-off on the first flight. After you have programmed a few different models, you will be able to do it too.

MORE GOODIES FROM JR

The receiver I am presently flying in my Concept 60 with the PCM-10S is the very new JR NER-226X ultra-compact six-channel receiver. JR calls this and the new NER-223X their "credit card" receivers because they are very thin—only 1/2-inch thick! Both receivers feature an upgraded version of JR's patented ABC&W circuitry, which makes them especially resistant to 21M and 31M interference.



This is the JR NEJ-1000 piezoelectric gyro you've been hearing so much about lately. Besides the fact that it has no moving parts and is less susceptible to vibration damage, its advantage over a standard gyro is its increased bandwidth, which is especially beneficial during precision maneuvers. More in text.

Over the last couple of months I have put in more flight time on the JR 4131 and 4721 servos. These are JR's top-of-the-line servos for model helicopters, and are equipped with coreless motors. They replace the older 4031 heli servos. So far, they have worked flawlessly. Both have fast speed and good centering, as well as a hefty price tag.

This summer, JR will introduce its new NEJ-1000 gyro, based on piezoelectric crystal technology. This gyro has no moving parts inside. When there is a yaw perturbation, a special crystal will bend and send a micro-voltage to cause the tail rotor servo to react. The benefit of this new gyro is that it will have an even higher bandwidth. For a slow yaw rate or small disturbance, a traditional flywheel gyro such as the JR-120 has the same linear output-to-input relation as the piezoelectric gyro. But for large disturbances and large yaw rate maneuvers, the output response of the flywheel gyro starts to fall off—it can't keep up. However, the piezo gyro can still produce a proportional output response to the large yaw rate.

For average flying, the benefit of the increased bandwidth will not be readily noticeable because the helicopter can only move so fast when there is a gust or pertur-

bation. You are rarely operating at the large input or high yaw rate region. The high bandwidth of the piezo gyro becomes beneficial only when you are doing rapid maneuvers or precision hovers, where any minute, instantaneous motion of the tail rotor is critical. An added benefit of the piezo gyro is that it draws less electricity and is less sensitive to vibration damage.

Besides the piezoelectric gyro, JR has introduced the new NEJ-160 mini gyro for electric helicopters. The NEJ-160 will sell for around \$100, the NEJ-1000 will be around \$200.

Presently I am testing an NEJ-160 mini gyro with my PCM-10S radio in the Concept 30. The gyro works surprisingly well. Horizon Hobby Distributors doesn't really recommend using the NEJ-160 for .30-size gas models because of vibration; they recommend it for electric helis only. But I wanted to see how much abuse the NEJ-160 could take, so I installed it in my gas Concept 30. After three dozen flights, there is no sign of diminishing performance. I think Horizon is just being conservative, because the original NEJ-160 ad in Japan advertised it for electric as well .30-size gas models. This lightweight unit may be perfect for the gas Concept 10. **MB**

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BY BOB STALICK

The "Crazy Checks" for FF Nostalgia

Do you remember the model airplane magazines of the 1940s and 1950s? The ones I recall are those that included full-size patterns for the curved parts of the free flight models being featured. They included measurements of the wingspan, chord and other important dimensions. They also had a little box somewhere in the article which gave you factors to use if you wanted to scale the model up or down.

Although these features occurred regularly in those days, the one I recall using the most was Ron St. Jean's RamRod from *Model Airplane News*. Ron featured the RamRod 250 as the plan, but he had one of those charts that allowed you to make the model in 432, 600 and 750 square inch sizes. I recall that I made all but the 750. Ron also included a copy of the full-size wing rib for each of these ships.

Do you also remember when some of the designers of the 1940s and 1950s would trace

flier's mind. As the design gradually changed from one form to another, it was as though you were actually there with him.

It's a pleasure when someone takes the time to share with us his thoughts as he works his way through the improvements in his designs. That's why it is a distinct pleasure to share with you this month's three-view. Read on and be enthralled.

AUGUST THREE-VIEW: CRAZY CHECKS

The Crazy Checks is a newly approved Nostalgia Class B/C model. At 720 square inches, it is one of a few models that does not need to be enlarged from its original size to be competitive. It is a simple model from a mid-1950s perspective. According to designer Jim Coffin, it was built in sizes from 225 to 1350 square inches. Jim notes:

"Between 1951 and about 1954, I designed and built a series of eight to ten free flight

ting three AMA national records in 1952 and 1953 with different versions, I drew a set of detailed construction drawings of the A/B/C size in the hopes of getting it published. With no takers, I gave away or sold all copies of the plans. I did keep the original tracings for awhile but apparently lost them when I moved from California to Washington, D.C. in 1965.

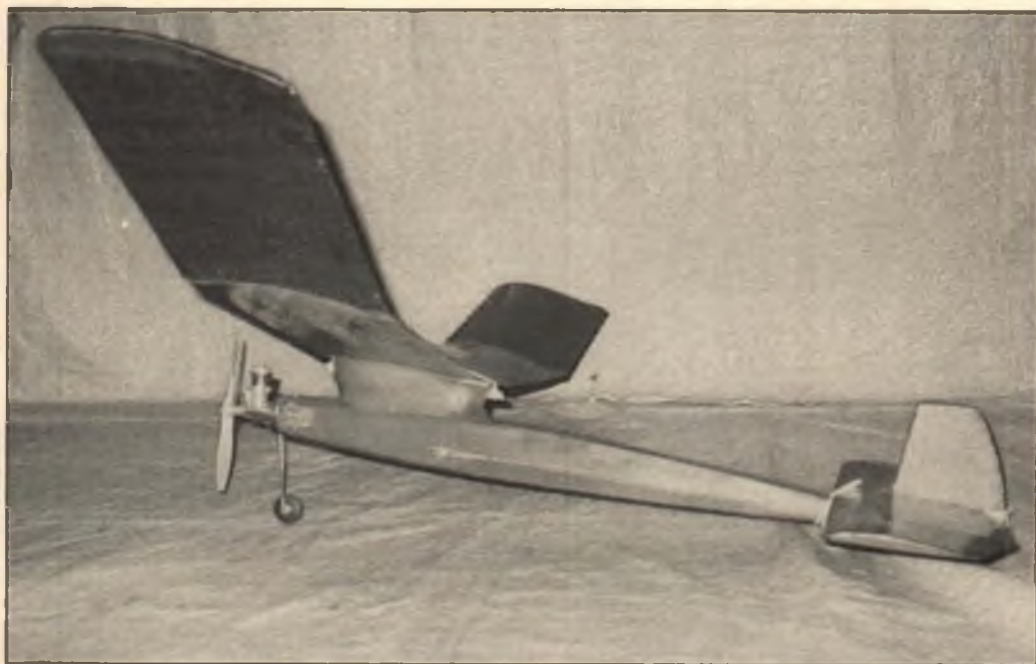
"I don't know if anyone ever built a model from the plans. One of my fellow Long Beach Thunderbugs club members did build a modified and enlarged near-copy that was published in Frank Zaic's 1955 Yearbook. This is Brad Broadwell's Class C model, which is on the NFFS approved Nostalgia list. Sal Taibi would remember my models and F.L. Swaney named the B/C job for me. 'Crazy Checks' was in reference to the red and black checkered silk I used on the wings and stabs.

"Other than memories, I do have the record certificates, a few pictures taken over a period of 16 years, a broken but repairable wing, several rib sets and patterns, and the rough sketches I made from one of the originals before it literally fell apart after 16 years of competition."

Jim also notes that the B/C model has a span of 73 inches and wing area of 720 squares. He has an .09 version that is 70 percent scale with a 360 square inch wing. This will fly with either a K&B Greenhead .099 or an O.S. Pet .098.

As you look at the three-view and the accompanying sketches, you can see how the model was derived from Ray Acord's Champion and then the first derivation in 1951-52 to the final version in 1952-53. The silk pylon fairing remains constant throughout the entire series, as do the nose and tail length.

Crazy Checks is a really nice model that has weathered time well. Jim has full-size plans available for both the B/C size and the 70 percent size. He has also developed a nice set of building instructions which will be available with the plans.



The Crazy Checks, this month's three-view, is a Nostalgia ship for B/C engines. Full-sized plans are available from designer Jim Coffin. See column for details.

out the history of their favorite design? They would include a sketch of the first prototype of the model and then provide the Mk. II, Mk. III and subsequent versions. This, for me, provided an insight into the builder and

models that I would like to resurrect and qualify for current Nostalgia competition. These designs were loosely patterned after Ray Acord's Champion, which I had used in competition until it was lost. After set-

Write to Jim Coffin, 4604 Hillbrook Dr., Annandale, VA 22003-5921.

AUGUST MYSTERY MODEL

During the Nostalgia period, several designs appeared with names that were oblique acronyms with sometimes risqué references to military experiences during WWII. Such names as Fubar, Snafu, AWOL and the like come to mind. This month's Mystery Model also has an unusual name, but it apparently doesn't mean much. The model was featured in a national model magazine and was subsequently kitted. It was available in two different but nearly equivalent sizes. It is alleged to be a very competitive design and should be considered for contemporary Nostalgia competition.

If you think you know the name of the model, send your guess to *Model Builder*. The winner will be drawn at random from among the correct entries received and will get a free one-year magazine subscription.

MAY MYSTERY MODEL WINNER

The June 1955 issue of *Flying Models* has produced two Mystery Models in a row—first it was the "Flying Ballooney," now it's Eddie Howe's "The Stare." Four readers mistook it for what must be a very similar ship, the "Slim Jim" as designed by Vern Oldershaw, which came out at about the same time. Of the nine correct entries, the free *MB* subscription goes to Jacob Longacre of Voluntown, Connecticut.

We especially enjoyed the note from Bob Langelius of White Plains, New York. Referring to *The Stare*, he writes:

"... I never saw it in print, but I saw the original many times at Curtis Field in Long Island, New York as a kid.

"My mom worked there during WWII at Columbia Aircraft. She made the cowlings for the Grumman Duck biplane. We used to see the end result each

day (production was one a day). The test pilot, a 'Frenchy' (his first name) something or other, would buzz our house on Fairfield St. My mom would be mad as hell because she worked the night shift and wanted to get her sleep. If you ever heard that roaring radial pulling that heavy biplane up about 200

feet over your house you'd be mad too—but we loved it! What a time for kids!

"A neighbor's son flew Thunderbolts (the old razorback model) out of Bridgeport, Connecticut. He'd beat up the neighborhood pretty well too. He was killed on his first combat mission and his mom gave

We've already got an .020 Replica event; how about .010 Replica? Pete van Dore, of Elkins Park, Pennsylvania, is ready with his 26-inch Playboy. Pete now has Playboys in five sizes, all the way up to the 80-inch Senior powered with an Atwood Champion.



MYSTERY MODEL

me his half-finished Scientific Varsity. Not so great times for grown-ups!"

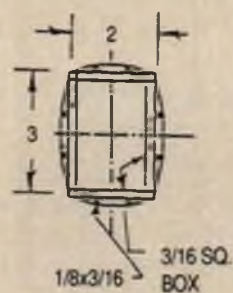
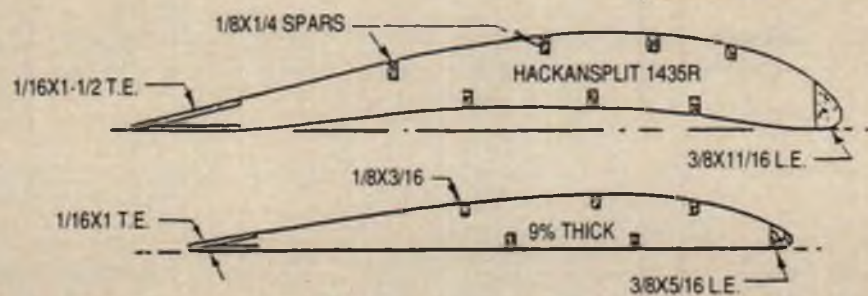
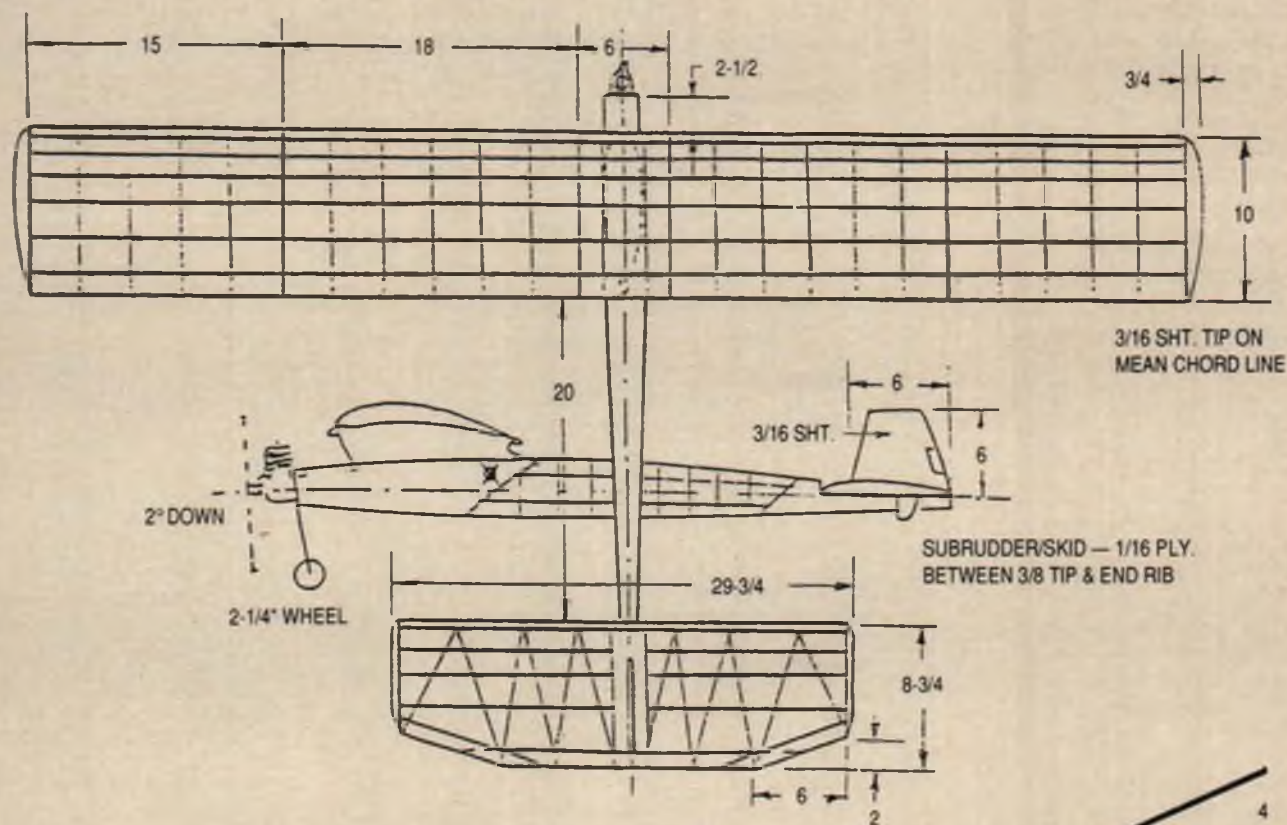
A MUST-HAVE CATALOG

I just received a copy of the new catalog from Oldtimer Model Supply (Ken Sykora's labor of love). As usual, the catalog is crammed with construction materials, plans, dope, tissue and the like not found in your run-of-the mill hobby shop. It's there at OMS.

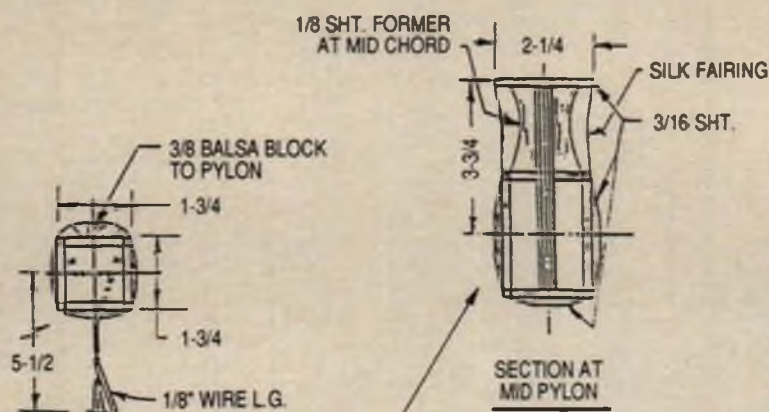
I enjoy Ken's humor, which appears throughout the catalog in the form of little quotes, such as: "I have a Reynolds Number, but since my Zip Code went to nine digits, I forgot it." There's more. Contact Ken at P.O. Box 7334, Van Nuys, CA 91409. Send along \$2.00 to cover the costs. You won't be sorry.

THE .010 SCENE

Here is how the Minipower Postal Contest is shaping up.



SECTION AFT
AT PYLON REAR



FIREWALL REAR
RADIAL ENG. MT.

SECTION AT
MID PYLON

"CRAZY CHECKS"

B/C NOSTALGIA FREE FLIGHT BY JIM COFFIN

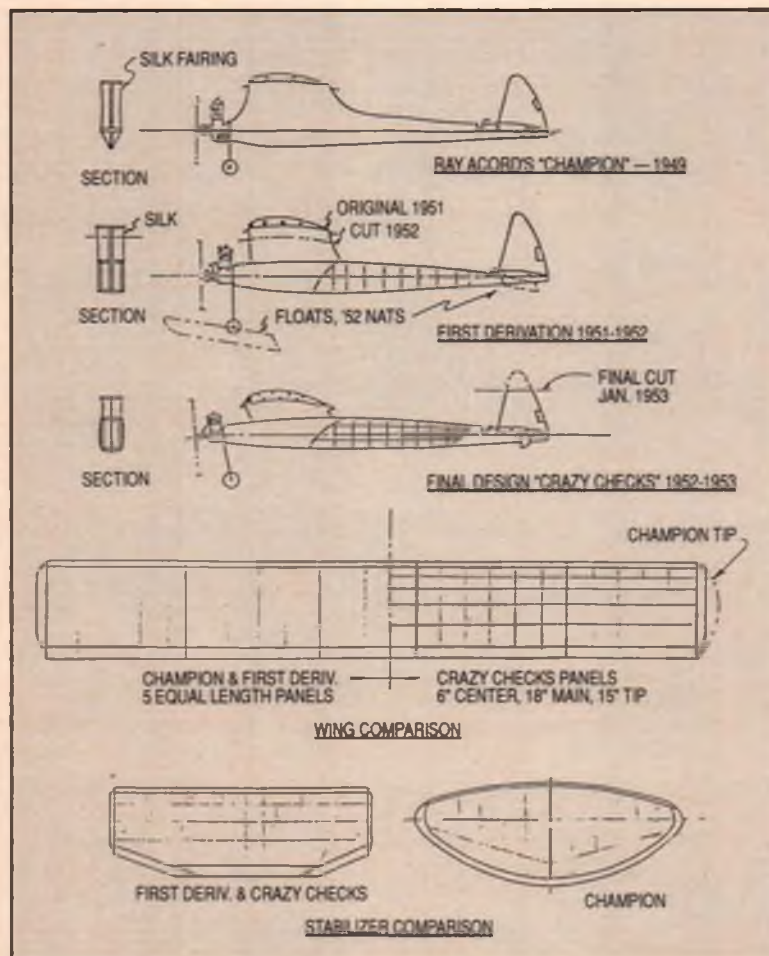
PLANFORM WING AREA: 732 SQUARE INCHES

FLYING WEIGHT: 32 OUNCES

POWER: ORWICK .29/.32 GLOW

NOTES: Three built as shown in 1952-1953 period and one slightly modified version in 1968 (K&B .35). One built in 1955 with 3 inches cut out of each wing panel (58-1/2" span) for Cox Olympic .15. Four or five others were built with wing areas from 225 (for 1/2A) to 1350 square inches (for Class C with Orwick .64). All of these were built between fall 1952 and summer 1955.

FREE FLIGHT



Jim Coffin supplied these sketches to illustrate the evolution of his Crazy Checks design, which has been approved by the NFFS for Nostalgia competition.

You will need to get your local C.D. to agree to sponsor an .010 Power event at one of your contests scheduled between August 1 and October 15, 1993. The event will follow these rules:

1. The model must be powered by a Cox .010 engine.
2. The model can be of any size or weight, but the engine cannot use any mechanical fuel shutoff system.
3. Flight times are 10-second engine runs and 2-minute maxes. Six attempts to make three official flights.
4. After three 2-minute maxes are made, flyoff flights begin with a continuation of 10-second engine runs and 2-minute maxes until either an engine overrun occurs or a flight of less than 2 minutes occurs.

The contest director must for-

ward the final results to Bob Stalick, 5066 N.W. Picadilly Circle, Albany, OR 97321 no later than October 25, 1993. An entry form with full requirements can be obtained by sending me an SASE at the above address.

Prizes for this postal event will be furnished by *Model Builder* and Cox Hobbies. MB T-shirts and subscriptions and Cox Tee Dee .010 engines are waiting for the winners. Send for your minipower packet ASAP.

THOSE COX .010 BACKPLATES

Good news for .010 fliers! As you know, Cox is presently selling the .010 only with the tank mount; the original type radial backplate mount is not supplied or even available. Now, from Hank Nystrom comes the following information:

"I spoke with a Cox representative at the Toledo Expo last week, and he told me that when production on the .010 was resumed, they could not find the radial mount mold. It has been located now, and they will be making them available separately as well as including them with the engines."

TERRY T. ASKS ABOUT .010 POWER

Terry Thorkildsen, one of the more competitive free fliers on the West Coast, wrote recently about minipower. Among his questions (and my answers) were the following:

"I would like to know what size model is best for these engines? I know that for an .020, I like something around 150 square inches. Also, I've heard that the original .010s are better than the new black ones. Is this true and if so, what are the power differences?"

I have only built two .010 models so far and both had wing areas in

the 90 to 100 square inch range. Both seem to have no problem getting into the air. Some of the folks I've heard from on the East Coast have flown considerably smaller models—from 65 to 75 square inches. They seem to do well, too.

I cannot say for certain that the new engines are any better or worse than the old ones. I have only a couple of examples of each type and the differences are unnoticeable. I do know that they will handle a large amount of nitro and will not run well on low-nitro fuels. I would suggest you break them in on at least 35 percent nitro, and if possible, run them on 45 percent or higher.

DOMEDUSTER PLANS PACKET 2

I just received the second installment of the Domeduster

plan packet from Stan Fink. Stan has a nice listing of a dozen indoor plans, from Joe Krush's world record holding MiniStick to a number of Peanut and Pistachio scale models. Plans are presented in an 11x17 format. The first edition was a big hit, and this one will be even bigger. The cost is \$8.00 including postage and handling. Send your order to Stan Fink, 1810 Pine St., Philadelphia, PA 19103.

HAVE YOU DISCOVERED FREE FLIGHT UNLIMITED?

Several months ago, I received a nice flyer from Lin Cochran, publicizing his new venture in the cottage industry arena. Lin calls it Free Flight Unlimited. He carries a full complement of electric free flight equipment and supplies as well as CO₂, Jetex and an extensive line of free flight kits. By now, Lin's selection should have expanded even more.

For more information and a copy of the catalog, contact Free Flight Unlimited at 759 Angels Lane, Tucker, GA 30084-1302. Send along an SASE and a buck to cover Lin's costs. If you are looking for unusual and hard-to-find items, this might be just the place to find it.

NOSTALGIA RULES BOOK AVAILABLE.

Nostalgia Rules Book #5 is now out. The differences are minor and mainly cosmetic from Book #4. One noticeable difference is that the book has been coded so that there is an alphanumeric system which will aid in locating the rules. New models that have been approved are included, as are some corrections in the old book.

Contact Bob Larsh for your copy. I don't have a current price, but the old one sold for \$2.00 including postage. Bob's address is 45 S. Whitcomb Ave., Indianapolis, IN 46241. **MB**

PLUG SPARKS

BY JOHN POND

Competitive Designs for the O.T. RC Limited Engine Run Events.

Last month we discussed some good competition model designs to use for the RC Texaco and Antique events. The idea was to present some alternatives to the Lanzo Bomber, a design that has surpassed even the Cleveland Playboy in popularity. Bombers in all sizes are flown today in every RC O.T. event except scale. This month we will look at some good alternate designs for the RC Limited Engine Run classes.

One must remember that the SAM Antique cutoff date is December 31, 1938. All designs and kits appearing thereafter are considered Old Timers, and have a limiting date of December 31, 1942. The Playboy and other post-1938 designs are restricted to the O.T. limited engine run events, while the Lanzo Bomber can be flown both in Old Timer L.E.R. and the Antique/Texaco events. Small wonder the Lanzo Bomber is so overdone!

The Playboy Senior is an outstanding flier that will handle very powerful engines. Photo

No. 1 shows the classic takeoff of one of this columnist's many Playboys. In Australia, the Playboy Sr. with a McCoy .60 is so popular that they are referred to as "Bloody Playboys." At the

1992 Australian SAM Champs, I counted no fewer than 24 Playboy/McCoy .60 combos on the starting line!

In SAM RC, experience has shown pylon models to have no particular advantage over cabin or non-cabin fuselage designs. As a matter of fact, in the August '92 column, this pylon vs. cabin effect was discussed, using the pylon and cabin versions of the Playboy Sr. as an example, with no great advantage seen for either type.

This columnist is as guilty as



Photo No. 1. Classic shot of one of Pond's many Playboy Seniors (we think this one's Orwick powered) demonstrating the steep climb-out after takeoff. Until the Lanzo Bomber came along, the Playboy was the most popular choice for the SAM RC L.E.R. events.

anyone when it comes to Playboys, as he has built (and rebuilt) 10 of them over a 10-year period. Most of them are still flying. However, recognizing the problem of the L.E.R. classes degenerating into Playboy-only events (before the Bomber came along, that is), this columnist built several excellent deep-belly designs, among them the C-Raider and the Sunduster.

The Sunduster can be seen in Photo No. 2. The model was originally equipped with a Webra .60. With the new rules

requiring 225 square inches of wing area for every 0.10 cubic inch of engine displacement, the model was re-powered with a rear-rotor K&B Torpedo .40 racing glow engine. Several modelers picked up on this design, and a few scaled versions were eventually built.

Probably my best deep-bellied flier was the C-Raider, powered by a glow front-rotor K&B Torpedo .40. This good-flying model not only climbed well, but had a peculiar tendency to sniff out thermals on its own.

This model fell victim to the famous "switch-off syndrome" and went O.O.S. at Lakehurst NAS. Photo No. 3, taken several years ago at Lake Elsinore (California) during test flights, is all that's left to remember.

Now, how about a good cabin model? The one that this writer has been touting for the longest time is the 1941 Megow Super



Photo No. 2. Experimenting with designs that would give the Playboy a run for its money, our columnist built this Jerry Brofman designed Sunduster with Webra .60 power. This was back in 1974, before the "225 sq. in./1 cu. in." rule.



Photo No. 3. John Pond's LaTorre C-Raider flew great with a K&B .40... until it went O.O.S. with the radio turned off. Another deep-bellied fuselage design, similar to the Sunduster.



Photo No. 4. A beautifully built Megow Super Quaker with Ohlsson .60 power, by Colorado's Ken Kullman. Ken used two fixed wheels in place of the original's single retracting wheel.



Photo No. 5. A 70-inch span scale Taylor Cub as built from Peerless plans by Eut Tileston. A real competition model. Photo by Fred Terzian.

Quaker. Photo No. 4 shows one in which the original single-wheel retracting gear has been replaced by a two-wheel fixed gear. (According to SAM rules, you can substitute two wheels for one, but not the other way around.) Ken Kullman turned

out an outstanding model, powered by an Ohlsson .60.

How about a scale model? Eut Tileston has made believers out of most of us with his hot-flying cabin models (Westerner, Scorpion Major, etc.). Photo No. 5 shows his Peerless Taylor

Cub of 70-inch wingspan. This model flies like a hot competition ship—practically straight up. The hallmark of Tileston's models!

There is a tremendous num-

blame it on my memory.

•Pylon

Playboy Senior
Playboy Junior
Swoose C
New Ruler



Photo No. 6. The elliptical-wing Douglas Y10-43 was chosen by Pete Van Dore, of Elkins Park, Pennsylvania, as a subject for the 1/2A Texaco Scale event.

ber of designs and kits available from the 1939-42 era, but only a relative few have proven themselves as contenders in SAM RC competition. The following is a list of those I have seen fly, and I mean fly well! If I leave out some obvious ones,

Sailplane

Kerswap
Gas Champ
Ranger
Wasp
Zipper

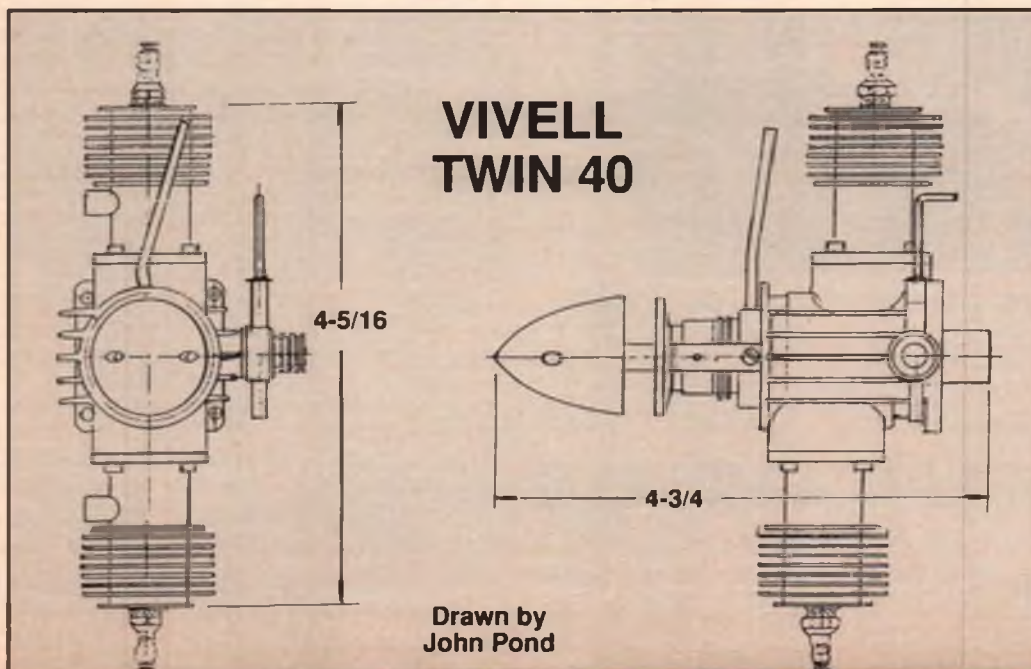
•Cabin

Playboy Cabin
Super Quaker
Thor
Buzzard Bombshell
Clipper Mk. II
Challenger
Brigadier
Coronet
Kloud Queen
Draftee

•Fuselage

C-Raider
Sunduster
Josephine
Candid
Feather Merchant
Record Hound
Hayseed
Folly
Lancer 72
Albatross

ENGINE OF THE MONTH



MODEL OF THE MONTH

For a change of pace, we are

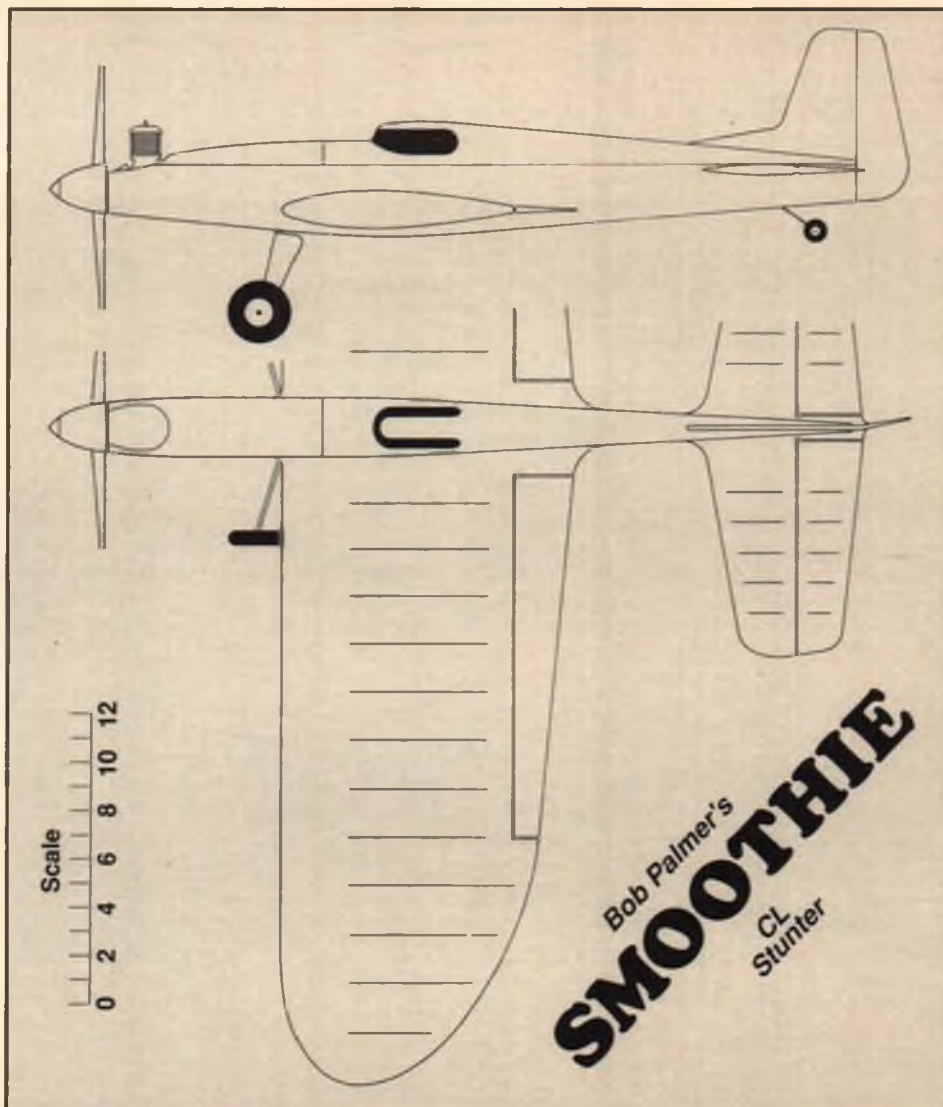
PLUG SPARKS

featuring an old time (nostalgia) control line model, the "Smoothie," as built and flown by Bob Palmer. Bob was the undisputed king of control line stunt during the late '40s-'50s era.

Although Palmer had suffered a serious hand injury, severing most of his fingers on a press, he was ingenious to the point where he made up a special shoe which fit over the remnants of his fingers, and at the same time accommodated a control line handle. More than one stunt man was heard to say, after losing a stunt contest to Palmer, that he should maim himself and fly with the same sort of prosthetic device.

Palmer was responsible for many of the designs that came out of Veco. Seems like everyone, including Mel Anderson, worked for Gil Henry, the owner of Veco, at one time or another. In correspondence with Joe Wagner (who also worked for Veco), it is his opinion that the Smoothie suffered from a higher wing loading than the average control line model. Palmer tended to build heavy, his finishes consisting of many coats of colored dope. The wing had more load to support, hence, more speed, which increased the looping radius. This factor was not readily seen in the first AMA stunt pattern rules, which allowed a 60-degree elevation. The rule change in 1950 reduced this angle to 45 degrees, putting a heavily loaded model to a disadvantage.

Regardless, the "Smoothie" is what its name implies—a smooth-flying stunt model and was widely copied by many others.



MODEL OF THE MONTH

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1/4 scale FOKKER DR1 TRIPLANE

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GLENN TORRANCE MODELS

1919-93 Woodhaven Cir, Rockledge, FL 32955
(407) 631-2519 Catalog \$1

The most unabashed was the "Calamity Jane," an English design that appeared in *Aeromodeller*. This was quite widely built in the countries outside the U.S.

The drawing shows the original model as published in *Air Trails*; this was followed by the Veco kit, which was engineered by Joe Wagner. The biggest change was in the cockpit height. This was part of the kit's simplification program, plus Wagner's penchant for realistic-looking cockpits. This use of a small cockpit was started in designs by J.C. Yates, Jim Saftig, and others, and naturally, after his association with Yates, Palmer adopted an even smaller cockpit outline. Wagner, who made the dies for both the Smoothie and the Thunderbird kits, reports that company owner Gil Henry abandoned the small pilot enclosure, replacing it with a bubble canopy.

Regardless, the Smoothie design by Palmer was an outstanding performer in his very capable hands. Bob was such a widely known name in control line that he eventually toured South Africa with Howard Bonner, making a control line and radio

continued on page 82

NEW AVIATION BOOKS

Comprehensive histories of these classic and antique airplanes - and their builders - are detailed and illustrated. Hundreds of photos, in each book, including original factory photos. Includes the planes, the men, the families. The complete story. Internationally Acclaimed - Our authors are the leaders in Aviation Heritage. Our goal is to continue to give you the best in Aviation Heritage.



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THE TAYLORCRAFT STORY — By Chet Peek

The complete story of the Taylorcraft Company and its airplanes are detailed in the new book, the Taylorcraft Story. The incredibly detailed history of C.G. Taylor and 65 years of Taylor and Taylorcraft airplanes. Hundreds of photos of famous people, planes under construction, original ads, articles, letters, and all the models from the first Taylor Chummy to the first Taylor E-2 Cub to the first Taylorcraft to the new F-22s, to include the production of the 13,000 Taylorcraft aircraft, including the British Auster model. 3-views of each model, plus a wealth of information from primary sources portrays the technical, financial, and marketing through the latest rebirth of Taylorcraft which still produces airplanes in 1992. Foreword by C.G.'s son, Bob Taylor. Specs, performance data, factory shots, early testing and construction, profiles of every model, engine specs, simply the most complete history available. The first and only Taylorcraft book! 8 1/2" x 11", 256 pgs., 423 photos. Softbound, #108, \$24.95; Hardbound, #108-A, \$34.95.



WACO - SYMBOL OF COURAGE & EXCELLENCE — By Fred Kobernuss

Deals with the evolution of the largest producer of commercial aircraft during the 1920s and '30s. For example, in 1927 this company built 460 airplanes while Boeing rolled out 25. Detailed history of the early personalities, early airplanes, up to Waco Model 9, and early airplane companies which existed before the formation of the Waco Aircraft Company. Airplanes include: 15 hp biplanes, DBJ biplane "Scout", Cootie #1, #2 & #3, and Waco Models - Waco 4, Waco 5, Waco 6, Waco 7 and Waco 8. Includes the inside story of the developmental stages of the Ohio Aviation School, the DBJ Aeroplane Co., the Weaver Aircraft Co., and the Advance Aircraft Co. Comprehensive "Waco" history from 1910 to 1925. 8 1/2" x 11", 190 pgs., 150+ photos. Softbound, #106, \$24.95; Hardbound, #106-A, \$34.95.



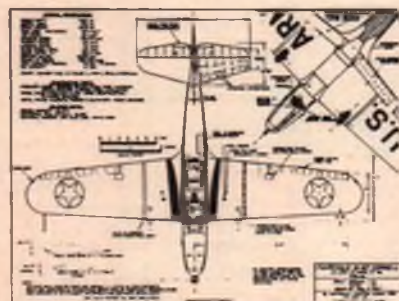
AERONCA - A PHOTO HISTORY — By John Houser & Bob Hollenbaugh

Includes interesting historical tidbits with comprehensive photographic treatment of Aeronca C-2, C-3, Model L (Low Wing), Model K, Pre War Chief, Model T (Trainer), TA (Defenders), Liaisons, TG-5 Gliders, Aeronca-built Fairchild Primary Trainers, Model 7 Champion, Model 11 Chief, Model 15 Sedan, Experimental Types, and Aeronca Engines. Includes All Variants. Illustrated with photographs the many different models of Aeronca aircraft, together with related photos of general interest, all arranged chronologically. 8 1/2" x 11", 138 pages, 250 photos, Chronological Listings, Pre War Production Chart, Post War Production Chart, Aeronca models with Power Plants, ATC Years of Manufacture, Comparison Specifications, & Appropriate Remarks per Model. Softbound, #701, Only \$14.95.



PIPER CUBS — By Peter Bowers

A classic presentation of the most famous airplane in the world. The "Cub" is many airplanes as Model production stretched over more than a half-century. Model-by-model, Bowers traces the evolution of the Cub including more than 200 illustrations detailing the differences in models and the myriad ways the Cub has and does perform aviation activities. The book describes each of the designated Cub models in sufficient detail to enable you to distinguish visually between such J-3 Cubs as the J-3C-40 and the J-3C-65, the prewar and postwar J-3C-65s, and the PA-18-125 and PA-18-135. Separate chapters describe some of the unique activities of the Cubs and the modifications that ingenious owners and operators have made to the basic tandem two-seater Cub to make it the world's most versatile airplane. 7 1/2" x 9 1/2", 240 pages, 227 photos & illustrations, 8 pages of full-color, 3-view drawings, Specifications, Index. Softbound, #248, Only \$17.95.



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HOBBICO'S AWAFF

40

STARFIRE

If you're interested in a sport aerobatic ship that entails minimum expense, minimum effort and maximum flyability, guess what! You're looking at what may be one of the best: Hobbico's AWAFF (all wood—almost ready to fly) Starfire 40. This .40-size low-winger comes from the factory with about 80 percent of the work already done, and when you add your 20 percent, you end up with a nice looking airplane that has excellent flying qualities.

The kit comes with all major components pre-built and pre-covered in an attractive multi-color scheme. The construction consists mainly of epoxying the wing halves together, gluing on the plastic turtledeck, installing the stabs and control surfaces, and installing the engine and radio sys-

This on-the-tarmac view emphasizes the Starfire 40's low-drag front profile. Considering its low cost, minimal construction time and exceptional flying abilities, the author feels this is one of the best ARF values around.



PRODUCTS IN USE • BY SKIP RUFF



Here's how the Starfire looks straight out of the box. All of the major components are of built-up wood construction—no foam cores—and come pre-built and covered, only a few evenings being needed to do the assembly and equipment installation.

tem. Of course, it doesn't go together quite *that* fast, as there are lots of associated little odds and ends to do along the way, but still, a week's worth of evenings should produce a completed ship for even the slowest of builders.

Along with the major components, almost all of the needed hardware is supplied, including the aluminum motor mount (which comes factory installed), fuel tank, spinner, wheels, pushrods, clevises, wheel collars, metal hinges, etc. Although full-size plans are not provided (or needed), an illustrated 24-page construction manual is included that outlines most everything you need to know. In view of all this and especially the lightweight wood construction employed, I was most

impressed with the kit.

If you've read this far, you're at least somewhat interested in the model, so I won't waste time detailing the assembly—that's the manufacturer's job. I would, however, like to go over what I liked, what I didn't like (I said the model was one of the best—not perfect!), and will offer some tips that, hopefully, will be helpful to anyone building this model.

To begin, the manual shows how to drill a hole in the leading edge of each wing panel, near the center, for the two 7mm wood dowels that secure the front of the wing to the fuselage, this being done before the wing halves are joined together. The dowels have to be precisely located to allow them to line up with the pre-drilled holes in the fuselage

A .40-size ARF hotrod, one of the four models in Hobbico's AWARF series.

HOBBICO STARFIRE 40

SPAN	55-1/2 in.
OVERALL LENGTH	49-3/4 in.
WING AREA	534 sq. in.
FLYING WEIGHT	5 lbs. 6 oz.
WING LOADING	23 oz./sq. ft.
POWER40-.45 two-stroke, .60-.70 four-stroke.
RADIO	Four channels required.
SUGGESTED LIST PRICE	\$164.95.
DISTRIBUTOR	Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021.

■ RIGHT: Skip never seems to have trouble finding a pretty girl to display his review models. Here, 10-year-old Jennifer Havens steals the show from the Starfire 40.

■ BELOW: The Starfire 40 performing at the author's home field at Tall, California.





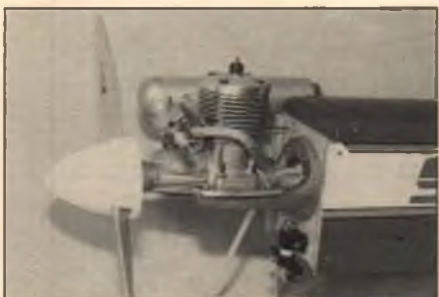
Is this enough hardware for you? The Starfire's hardware package is as complete as one could ask in an ARF model.



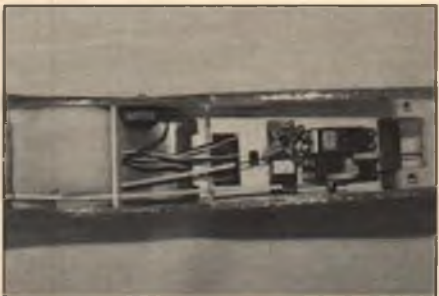
Box-stock wing panel reveals the wood construction. The wing is completely sheathed with balsa and has hardwood spars top and bottom. A hardwood joiner between the spars ties everything together when the two panels are joined.



Aileron servo installation. For extra strength, Skip stripped off the covering over the wing panel joint and added a 1-inch strip of glass cloth and epoxy.



Skip has nothing but praise for the K&B .45 Sportster he used in the Starfire. For a sport engine, it's a real powerhouse, and its light weight undoubtedly accounts for the airplane coming in a couple of ounces under its target weight.



View of the Futaba radio installation in the Starfire. Receiver and battery are at the far left, wrapped in foam.

bulkhead. To guarantee perfect alignment, I instead joined the wing halves first. The wing was then temporarily taped in its proper position in the wing saddle and the dowel hole positions marked on the leading edge with a pencil stuck through the bulkhead holes. After removing the wing and drilling the holes, the dowels were installed using plenty of slow-cure epoxy and the wing again was taped to the fuselage until the epoxy cured.

Although not called for in the instructions, I removed a 1-inch wide strip of covering along the wing panel mating joint and epoxied a 1-inch strip of glass cloth over the joint for added security during high-G maneuvers. This supplements the kit's strong hardwood spar joiner that gets epoxied in place when the panels are joined.

The motor mount installed on the fuselage is a universal type designed to have the engine bolted to two aluminum plates, which are in turn bolted to the mount, thus allowing one mount to fit a variety of engines. The 1/8-inch thick plates in my kit were very soft—I was able to bend them with my fingers. In the end, I chickened out and made new plates out of 1/8-inch tempered aluminum, just to be on the safe side.

When assembling and installing the fuel tank you might want to add a third line for filling; it's easier than pulling the fuel line off the carb to fill through. You'll probably need to plug either the fill or overflow line to keep sloshing fuel from running out when the engine is running.

The manual instructs you to install the receiver battery pack on top of the fuel tank and then glue the plastic turtledeck in place on top of the fuselage, which renders the battery pack completely inaccessible—not a good idea! A more conventional solution is to simply install both the receiver and battery in the forward end of the radio compartment. This may necessitate moving the aileron servo in the wing a couple of inches aft of its specified position for adequate room. If you do this, make sure the aileron servo is mounted deep enough in the wing that it won't interfere with the servos mounted in the fuselage.

Before gluing on the turtledeck, install the pushrods to the tail surfaces and check for proper alignment and no binding, as adjustments or alterations are much easier with the deck off.

A few words are in order about the covering material used on the Starfire. It is a sticky-backed, non-heat-shrink film with the color applied to the surface. If you get air bubbles or wrinkles in the covering, as I did when the model was left in my garage during a hot spell, you cannot take them out with a heat gun. Don't even try, you'll just end up melting the covering! I did find that on the sheet balsa covered surfaces, which comprise everything except the horizontal stab, the bubbles or wrinkles can be removed almost entirely with a covering iron.

The procedure is to turn down the iron to its lowest setting, apply it gently to the af-

fected area, and rub the covering down until the bubble/wrinkle has disappeared. Be sure to apply pressure gently and never stop moving the iron when it's in contact with the covering. The heat seems to both soften the covering and reactivate the adhesive so that it stays stuck down. Where there might have been a large wrinkle, you'll now see, with close examination, only a very small crease. I haven't yet had any such treated areas come loose a second time, no matter how hot it's been.

As for the open framework horizontal stab, well, I haven't figured out what to do about that yet. Truthfully, I'm unconcerned about it, as in cold weather the covering is tight and only loosens up when it's warm out. The model's flight characteristics are unaffected in either case.

As mentioned, the color scheme is factory applied to the surface of the covering and doesn't seem to be affected by household cleaners such as Formula 409, or by methanol or exhaust residue. However, I've found that some paint thinners and also raw nitro will take the color right off! Reasonably careful fueling procedures should avoid any problems. It's also wise to seal with epoxy all of the bare wood areas that could possibly come in contact with fuel or exhaust goo.

The engine supplied for this review was the K&B .45 Sportster, and since this engine has been available for some time and covered in detail in numerous other articles, I won't get too deep into it. Suffice it to say that, once broken in, it runs and idles very well. It is one of the quietest two-strokes on the market, has good power, comes with its own mount (which was not used in this particular application), glow plug, and extra needle valve, and at a suggested retail of only \$99, is certainly economically priced! I consider it an excellent choice for this model, especially if you're on a tight budget.

With the model completed and my Futaba Attack-4 radio with standard S-148 servos installed, I was pleased to find that the model not only balanced right on the money, but also came out 2 ounces under the recommended flying weight of 5-1/2 pounds.

The first flights required negligible trim change and confirmed that the recommended control surface throws offer a good balance between responsiveness and docility. The Starfire is fast, groovy, and able to handle loops, rolls, spins and snaps (both inside and outside) with ease. Throttled back and with full up elevator, the model is reluctant to stall, making slow landings a breeze. In fact, the model will land and take off at a high enough angle of attack to drag the tail. Bending the main gear legs a bit to provide more ground clearance and adding a tailskid will save wear and tear on the rudder.

With its good looks, excellent parts fit, superb flying abilities, and low price (around \$130 at some stores), Hobbico's AWARF Starfire 40 is a winner. Were I to get a case of "dumb-thumbs" and auger it in today, I'd be on the phone to order another tomorrow! **MB**

When it's got to build fast, look sharp, and burn holes in the sky...



Wingspan: 56"
Wing Area: 546 sq. in.
Weight: 5.5 lbs.
Engine: 2-Cycle .40-.45
or 4-Cycle .60-.70
Radio: 4-Channel

Photo shot on location at Champaign County Radio Control Club.

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Hobbico AWAREs' covered wood wing (balsa sheeted on the Starfire 40), balsa and ply fuselage, and pre-colored ABS turtle deck and cowl make assembly fast and accurate. Generous hardware packages include tires, fuel tank, spinner, and engine mount.

loops, and stable knife edge on your command.

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Flightstar 40



Avistar 40



Hobbistar 60

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HOBBY SHACK'S *Super Ridge Runt*

A good flying slope glider is a great find. A good flying slope glider that retails for under \$50 is an *outstanding* find. Hobby Shack has given us both of these qualities in the form of the new Super Ridge Runt, a three-channel, higher-performance version of the original Ridge Runt, an entry-level aileron/elevator sloper that's been on the market for the last couple of years.

THE KIT

Two of the most important ingredients in any kit are the instructions and the plans. The Super Ridge Runt's instruction manual contains 18 diagrams throughout the eight pages of building text. Some of the building basics are not present in the manual; I assume this is due to the advanced nature of the plane. The plans are full size, well drawn (by computer), clear and not cluttered.

The Super Ridge Runt's wing uses the

SUPER RIDGE RUNT

TYPE: Aerobatic slope glider.
WINGSPAN 52-1/2 inches.
WING AREA 320 square inches.
WEIGHT 29 ounces (as tested).
WING LOADING 13 ounces per square foot.
RADIO Three channels required
(aileron, rudder and elevator).
SUGGESTED RETAIL PRICE \$49.95

PRODUCED BY: Hobby Shack, 18480 Bandilier Circle,
Fountain Valley, CA 92708; (714) 963-9881.

COMMENTS: The addition of the rudder (which is not found on most small slope gliders) makes possible such aerobatics as knife-edges, accurate point rolls and dramatic stall turns. This is a zippy little sloper. Definitely not for the first-time beginner!

semi-symmetrical Eppler 374 airfoil, which has been a favorite of slope fliers for many years. The wings are wire-cut white foam cores, to be sheeted with 1/16 balsa. The vertical stab is a 1/8 balsa core (pre-cut for the recommended Sullivan flexible elevator pushrod) sheeted both sides with 1/16 balsa. The fuselage is balsa with lite-ply formers; a pre-shaped nose block and a clear molded plastic canopy add to the unique look of this little sloper. Aileron torque rods, wing hold-down bolt, hinges and control horns are also included, but you will need to purchase aileron pushrods and clevises and the Sullivan #507 cable pushrods for the rudder and elevator.

All of the balsa and lite-ply components in my kit were fairly well cut and required only a light sanding. The leading and trailing edges of the wing cores were not quite as straight as I would have liked, however, they were easily fixed by lightly sanding with a sanding block.

CONSTRUCTION

As I mentioned earlier, some of the basics are left out of the building manual. The wing sheeting section is not for the novice. Six pieces of 1/16 sheet balsa are needed for the wing, however, the plans mention the need for only four. (Don't worry, there are six included.) The density of the balsa was fairly equal and needed only a bit of edge trimming before joining them with white glue. I applied the finished skins to the cores with 3M "77" spray contact adhesive, weighted them down in their beds and let them dry overnight.

The leading and sub-trailing edges were added with five-minute epoxy. There is a lite-ply center rib between the two wing halves, which has a notch for the front hold-down dowel. Epoxy was used to glue everything together. The only dihedral is the taper of the wing; therefore, the wing panels are glued together top side to the bench. Installa-



tion of the aileron torque rods and center trailing edges is standard for planes utilizing one aileron servo.

The horizontal stab and elevator are made from 1/8 die-cut balsa. The vertical stab is a three-piece lamination as described above; a 1/4-inch square balsa tailpost adds strength when the tail group is glued to the fuselage. The die-cut balsa rudder is also from 1/4-inch stock. There are no pre-shaped tapers in

PRODUCTS IN USE BY RICK LAWRENCE

Rick Lawrence launches the SRR for another wild ride on the dunes overlooking the beach at Cape Cod, Massachusetts.



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Hobby Shack's Super Ridge Runt kit includes all required balsa, wire-cut foam wing cores, canopy, most of the necessary hardware, and plans you could frame and hang on the wall.



Tail group components partially assembled; note the channel in the 1/8-inch balsa fin core for the 1/32-inch Sullivan cable pushrod.



The two completed wing halves with the sheeting, leading and trailing edges installed. Note that the center lite-ply rib is notched for the wing hold-down dowel and aileron servo. Wing panels will be butt-glued together and then reinforced at the center with a strip of 2-ounce fiberglass cloth top and bottom.

these parts, so the better you shape the leading and trailing edges, the nicer the plane will fly. The tail group is installed to the fuselage only after everything is covered.

Building the fuselage is quick and easy. The sides are 3/32 balsa with 1/4 square balsa longerons in the corners. The lite-ply formers are die-cut and required a bit of extra sanding to make them fit correctly. Fuselage bottom and top are 3/32 balsa sheeting installed cross-grain for strength. The Sullivan cables are installed before the top sheeting, making sure the elevator pushrod sleeve is sufficiently long to run through and exit the vertical stab.

COVERING

The covering sequence is fairly well described in the manual. Actual covering tech-

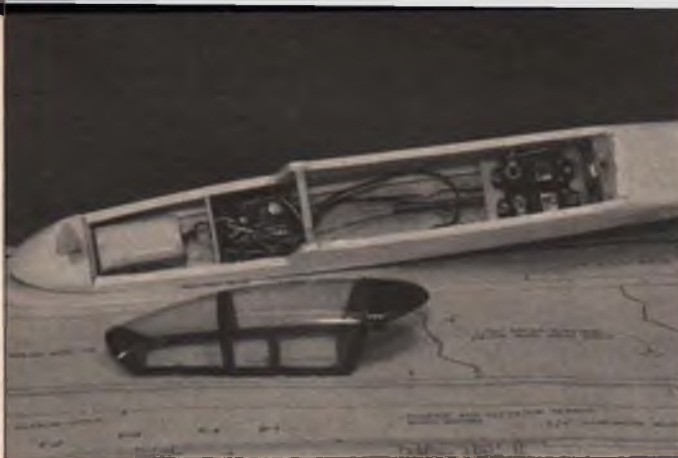
niques will of course vary with the brand of covering used. I used Super MonoKote and MonoKote Trim for the entire project, which required two partial rolls of white and red.

RADIO INSTALLATION

I was surprised to see that the elevator and rudder servos were to be mounted so far aft. The plans show both servos mounted at the extreme rear of the wing mounting bay. My experience tells me that most sailplanes come out tail-heavy; this location, it seemed, would only add to the problem. To give the kit a fair test, however, the servos were placed as shown.

To finish the pushrod cables, I bent 1/16 O.D. brass tubing into a Z-bend, then soldered this over the control surface end of the cable. On the servo end I soldered another

A good view of the radio installation and finished canopy. Note the antenna tube on the fuselage bottom between the servos. Author used a Futaba R114H receiver, Hobbico CS-31 micro servos and a Futaba 500-mAH battery pack. Components were later moved around somewhat to help cure a nose-heavy condition—see text.



Balancing the Super Ridge Runt ultimately required 6 ounces of lead fishing sinkers in the nose to establish a good glide path. Author has some recommendations for lightening the tail so as to minimize the amount of nose weight required.



piece of 1/16 tubing, which fits into a Du-Bro Easy Connector on the servo. Tinning the exposed cable at both ends for stiffness is a good idea.

The servos I chose were Hobbico CS-31 micros. These are less expensive than other brands but are powerful enough for this application. My Futaba FP-R114H receiver fit easily in the provided space. The most forward compartment has enough room for a 500-mAH battery.

The included aileron torque rods were fine. The included connectors, however, were not the same as on the plans or in the manual, and caused the controls to bind. I substituted a pair of Du-Bro #103 Strip Aileron Horn Connectors, which adjust much like the Easy Connectors—loosen the screw and move. The aileron servo was placed in the bottom of the wing (a servo-sized notch in the lite-ply center rib gives this location).

There was no provision for antenna routing on the plans. An old pushrod sleeve was installed, during construction, for this purpose.

The entire plane, built, covered and radio installed, weighed 23 ounces—exactly midway between the quoted target weight of 22-24 ounces. Balancing was a different matter; 10-1/2 ounces was needed in the nose to balance at the specified CG. Building time was relatively short: 27 hours of bench time.

PERFORMANCE

The first hand toss showed a problem: the plane had a high sink rate. I removed one 3/4-ounce weight and tossed the plane again; it flew better. I continued this until it had an

acceptably flat, fast glide path. The final flying weight was 29 ounces, and the CG was 3/4 of an inch farther aft than shown on the plans.

The first full slope flight was on a 100-foot dune in an 18-20 mph ocean breeze. From the start the Ridge Runt moved out well, with only slight down elevator trim needed. Penetration was no problem.

The Super Ridge Runt is a hot little aerobatic plane. Loops were smooth, round and easy. Of my six sailplanes, this one's roll rate is the quickest. Having rudder control makes stall turns a breeze, and four-point rolls are even easier. I was also able to do partial knife-edges, something I thought was lost when I moved from powered flight to sailplanes.

Most of my flying is on inland slopes, where the Ridge Runt's rather heavy wing loading limits its ability to fly in light lift. To attack this problem, I decided to lighten the airframe. I drilled four 1-1/2 inch holes in the horizontal stab and removed much of the 1/8 balsa center core of the vertical stab. The rudder and elevator servos were moved forward to the receiver compartment and the receiver was placed under the aileron servo. These changes resulted in a weight loss of 3 ounces, dropping the wing loading from 13 to 11.9 ounces per square foot.

CONCLUSION

The Super Ridge Runt looks sharp in the air, builds quickly and easily, flies great, and all this for under \$50. I am looking forward to doing a lot more flying with this plane as the flying season gets into full swing. **MB**

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OIL 'EM AFTER YOU RUN 'EM

Treating your engine with after-run oil after a day's flying can spare you the trouble—and cost—of having to replace corroded bearings and other internal parts later on.

I had a very unusual experience with my Saito 270 four-stroke recently. Ever since it was new, I had found it impossible to run the engine over 30 minutes or so without the valves loosening, resulting in a loss of power. After fighting the problem for two years, I sent the engine in to have an expert troubleshooter check it out. The engine was returned with new lifters and crankshaft bearings and some advice to use a different after-run oil.

My after-run oil of preference is Marvel Mystery Air Tool Oil—a very popular after-run oil recommended by most engine gurus. I couldn't believe it was the oil, so I checked further.

My frugal ways were probably the cause of my problems. I was putting only about six drops down the carburetor and calling it good. Now I disconnect the fuel line and pour a large dose of oil down the carburetor. Additionally, I pour quite a bit down each exhaust stack and then, using the oil can for pressure, fill the crankcase breather hole until a drop comes out of the front bearing. I am going through a lot more Marvel Mystery Oil now, but the engine seems to be holding its valve settings and the bearings are staying nice and shiny.

When it comes to properly treating the inside of your engine between flying sessions, keep in mind that the fuel you use is also important. Some fuels have very good anti-corrosive additives in them, while oth-



This isn't just another Super Cub. Jerry Gray has superbly detailed his O.S. 2.40 powered model and added metal-covered floats as well. All photos this month were taken at the 1993 Northwest Model Expo.

ers seem to have none. I had to let my O.S. 1.20 four-stroke go with no after-run oil recently, but found that the Davis Nitrothane fuel I was using has not corroded any of the bearings. Nitrothane uses a little more castor oil than is found in most other fuels and has some good anti-corrosive additives, too.

Add to all of this the different weather

conditions which affect the moisture in the fuel/air mix, and you will observe that your engine will be better protected by using a good after-run oil.

I was discussing the corrosion problem with Walt Wyrick. Walt said that he felt the purpose of the after-run oil was to disperse any residual fuel, alcohol and nitromethane that remained in the engine. Walt uses a good deal of after-run oil in his four-stroke engines, then drains them of fluid and caps all of the openings.

I have been using a Varane oscillating pump on my Saito 270, and after a month of sitting on the bench it was so corroded that it would not work. I filled it with Marvel Mystery Oil and left it to soak for a few minutes, after which it worked fine. Now I drain the pump after every flying session, then run some Marvel Mystery Oil through it and cap it off. This seems to work very well because the pump has remained uncorroded ever since.

The loosening valve problem seems to be solved now, so I will hope for the best in the future and keep my engines thoroughly oiled after each day's flying. That should eliminate any further problems with corrosion and its attendant problems.

REVERSED CONTROLS—BAD NEWS!

One of the most important pre-flight



Larry Meyers did a great job of building and detailing his Ikon N'west Monocoupe 90A.

checks that Big Bird pilots can make is the flight controls on their airplanes. With the advent of servo reversing on our transmitters, it is easy to keep things straight. In the past it was necessary to plan ahead and actually hook up and determine correct control direction during construction to insure that everything worked properly, but nowadays we just make our control systems work smoothly and then flip a switch for the correct direction of control surface travel.

I have been using my Multiplex transmitter for both my Spacewalker II and Big Bee. Switching from one to the other requires reversing the throttle and ailerons and changing from PCM to PPM. No sad story here because I always check for proper control surface travel as part of my pre-flight check. Also, since I usually take only one of these models with me to the field, I prefer to do my preparation in the workshop, so that if any problems do pop up, I have a shop full of tools and equipment available to make the necessary changes or repairs.

A good friend was not quite so fortunate. He had recently purchased a used Big Bird, his first large model. During the course of setting up his new plane he had to reverse several of the controls (he too was using one transmitter to fly more than one model). A week later, at the flying field, he carefully checked out his favorite older small plane; unfortunately he did all of his checks with the wing off and proceeded to take off with reversed ailerons. Quick thinking and a quick reduction of throttle resulted in only a slightly wrinkled model. The servos were then set up properly and the plane was carefully examined to make sure that the pilot's bruised ego was the most serious damage. Many successful flights followed.

This little incident prompts me to remind everyone to do a thorough check of your model in the workshop before you leave for the field. Even if you have pre-flighted your plane at the field, be sure to move those controls and check them out with the plane pointing away from you as you taxi out for takeoff.

These checks are really important on Big Birds because even one reversed flight control will usually cause enough damage to end the day's flying, or worse, the end of your favorite Big Bird. To protect your investment and the safety of other pilots, make a thorough flight control check part of your routine pre-flight check list.

MULTIPLEX SERVICE

I was using my Fred Morgan-designed expanded scale voltmeter the other day, when I remembered that my friend Fred had passed away. Fred left behind some very well designed equipment and many happy Multiplex owners whose equipment he had serviced. I am sure it is of some comfort to Fred's family to know he was highly respected by his friends and customers. He will be missed.



An excellent finish on his Sukhoi SU-26m by Jim Hyson. Shouldn't be long now before models of the new two-place Sukhoi SU-29 start showing up.



Jerry Nelson's all-metal plane is something different, and always attracts a crowd at trade shows. Aluminum structure is actually riveted together, using brass grommets in a pop-rivet fashion. When finished, the grommets are filled with solder and sanded flush, and when painted, could not look more realistic.

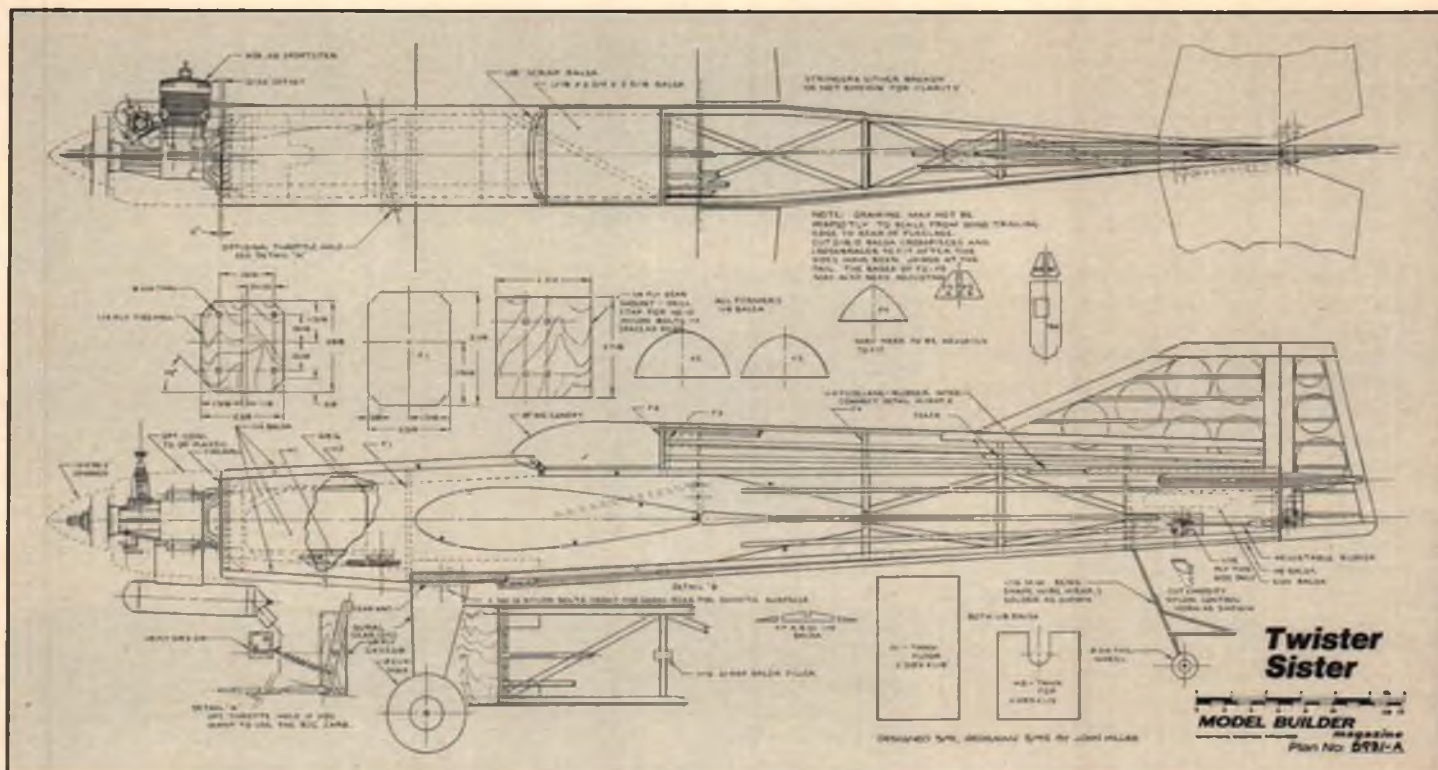


Steve Hanson did a super job of MonoKoting his Ultra Sport 1000. Big Birds columnist Bruce Edwards is in the process of finishing up a review of this attractive Great Planes kit, to appear in *MB* soon.

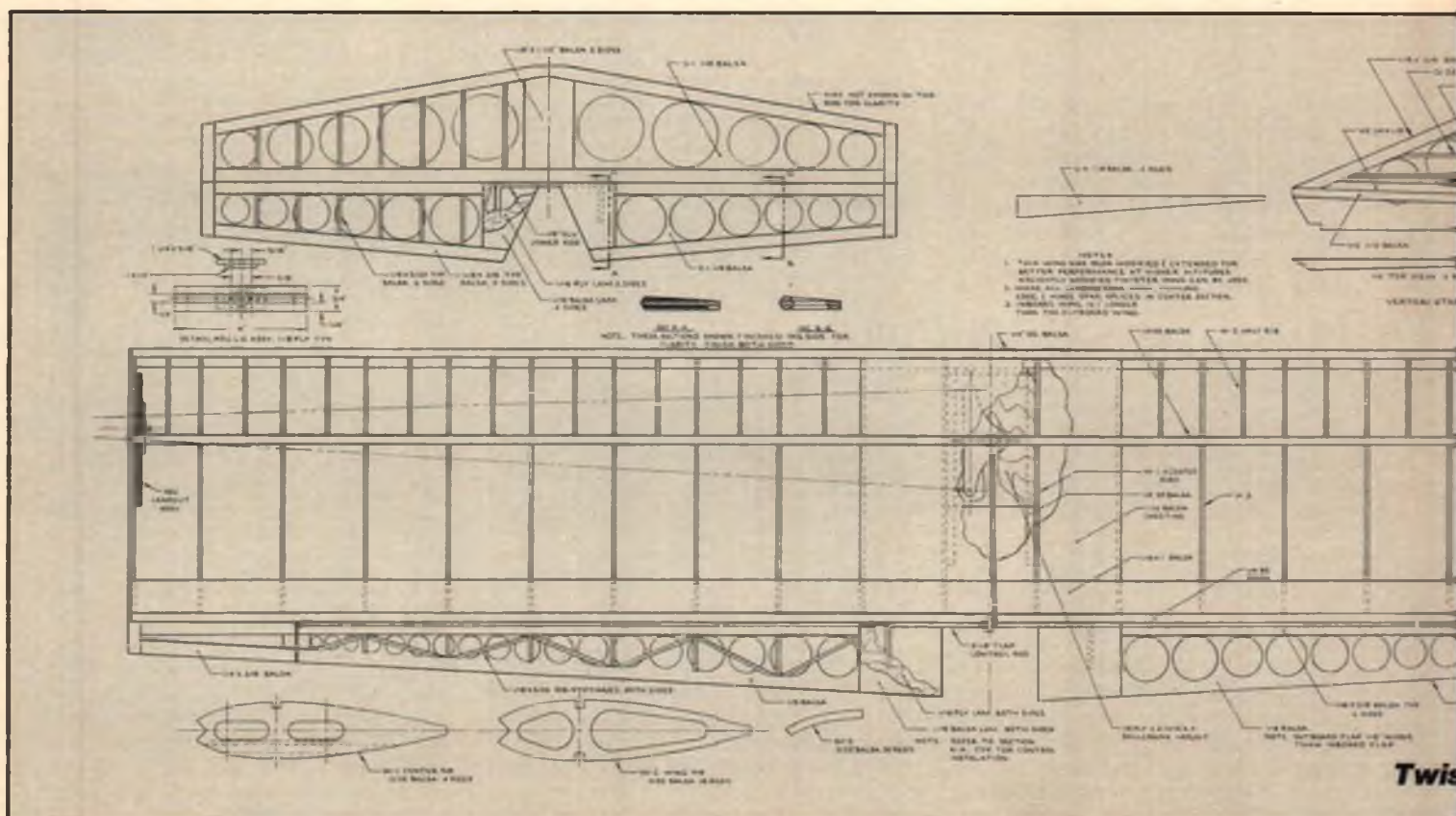
Bob Boomer, the Multiplex distributor in the United States, said he had a difficult time finding someone to fill Fred's shoes as his Multiplex Service Technician, but did manage to talk Dennis Kolman into tackling the job. Dennis is capable of servicing all makes of radios and may be contacted at

8213 N. 29th Ave., Phoenix, AZ 85051; (602) 995-8299.

It is mid-April as I wrap up this column and I am way behind on my flying time, so I'll see you next month. Bruce Edwards, 8304 53rd St. Ct. W., Tacoma, WA 98467; (206) 564-4416. **MB**



TWISTER SISTER



TWISTER SISTER cont. from page 39

washer to the pushrod if using a metal one. Mix up a small amount of epoxy and swab it over the nut on the bellcrank bolt so it won't come loose. While you're at it, swab some into the set screw area of the wheel collar for the same reason.

Sheet the top and bottom center section with 1/16 balsa. Build and install the adjustable leadout guide, the wingtip weight box, and the plywood wingtips. If you want fancier tips, by all means add them. Make them any shape you want—just remember to keep them light.

The flaps are laminated to help avoid twists that may be inherent in single sheets. The main piece or core is from 1/8 medium-soft balsa; note that the outboard flap is 1/8-inch wider than the inboard flap. The lightening holes are easy to make using a Dremel tool and a drum sander. Cut the slot for the 1/8-inch flap control rod at each end. Laminate 1/16 plywood on the top and bottom at the root of the flaps. Glue the 1/16x3/8 balsa strips top and bottom, and install the 1/16x3/32 "ribs" on both sides as shown.

After both flaps are finished and sanded, set them aside and build the flap tip pieces as shown. Note that the outboard one is adjustable. Glue the inboard flap tip in place; be sure to keep it straight.

The method you choose to cover the wing and flaps will determine how and when you hinge them together. I like to use MonoKote-type hinges. Cover the wing and flaps with the covering of your choice. If you use a



You can make the construction go quicker by cutting out as many of the parts as possible before starting the assembly. Author recommends using "See Temp." plastic template material for transferring patterns to balsa. (Write to See Temp., P.O. Box 105, Sussex, WI 53089, or call 800-423-1257 for details.)



The prototype T.S.'s wing was built on a homemade wing jig. However you do it, it's imperative that the wing be built perfectly straight and with no warps whatsoever.



The finished left-hand wingtip. Note the slot for the adjustable leadouts—important feature for bringing the model into optimum trim.

plastic iron-on film or fabric, select the base color now and add the trim later.

TAIL SURFACES

These are likewise laminated together to make them more torsionally warp-resistant. Construction is similar to the flaps, but the ribs run straight instead of diagonally. Use light wood—weight in the tail is not good. After construction and sanding are finished, it's time to cover. Use the base color again and do the trimming after final assembly. Cover the rudder but not the fin at this time.

FUSELAGE

If you study the plans carefully you will see that I've departed from standard "stunt ship construction." The construction is more like that found in RC. I'm really following Rule #2: Build it only as strong as it has to be. Accordingly, the nose is built from sheet balsa with triangle stock filling in the corners. A plywood firewall is used with a radial-mounted engine. Aft of the wing, square balsa stock is used to frame out and support the tail surfaces.

It's interesting that after several hard land-



Sig bellcrank bolts to a 1/8 plywood plate. Note the doublers at the spar and leading edge butt joints; there are similar doublers on the inside of the top and bottom trailing edge sheeting also.



This view gives a good idea of the optional wingtip outline before it all gets carved and sanded to shape.



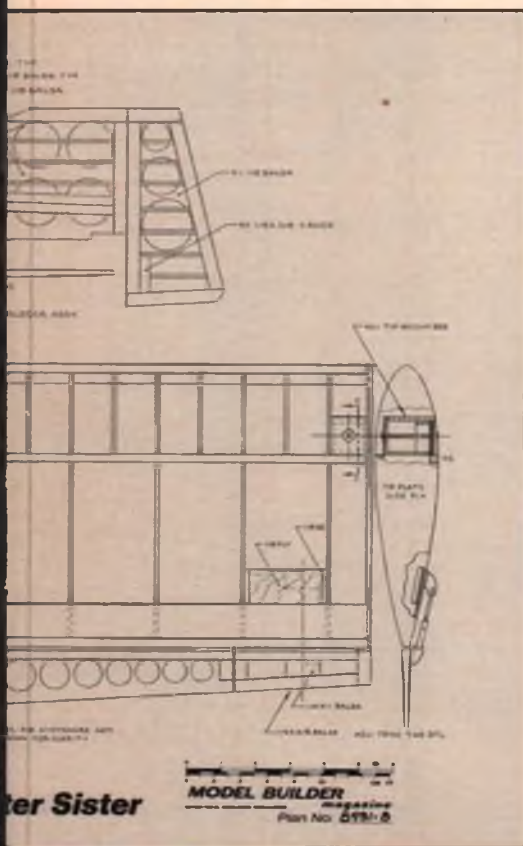
Use a long sanding bar or block to even up all of the ribs.

ings (crashes), not much damage has been done to the fuselage. The first incident required a nose rebuild after bouncing in at an acute angle. The wing needed to be recovered on the bottom where the knock-off gear punched into the wing. The aft fuselage and control surfaces were not damaged.

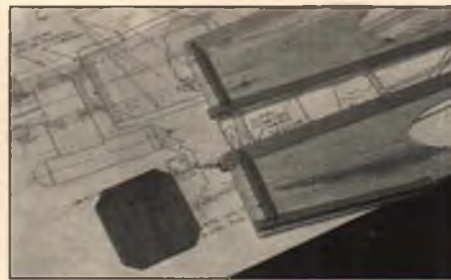
The second crash was straight into concrete. It was so hard that the engine was split in two, but again the repair only required a new nose. There was no damage to any other part of the plane. The gear popped off away from the plane, so it didn't poke into any part of the wing.

I believe that this type of construction exhibits a cushioning or shock absorbing characteristic that so far has saved the plane from any really extensive damage.

The fuselage looks a lot harder to build than it really is. Start with the nose pieces—use light wood. Prepare the nose pieces with datum lines and bulkhead location lines. Pin one of them in place, or use my favorite method, a very light coating of 3M "77" spray contact cement. Stick the longerons in place and trim them to length. Cut and place the cross pieces and diagonal braces over the



MODEL BUILDER
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■ **LEFT:** Wing flaps are made of a 1/8-inch balsa core, full of lightening holes, with 1/16 balsa strips on both sides. ■ **CENTER:** Tail surfaces are built up like the wing flaps—a lightened 1/8 balsa core, but with 1/8 balsa strips top and bottom. ■ **RIGHT:** Forward fuselage sides are 1/4-inch balsa with 3/8-inch triangular stock in the corners and also directly behind the 1/4-inch plywood firewall. The right fuselage side is 3/32-inch shorter than the left, to provide the necessary right thrust. Mark the engine mounting bolt pattern on the firewall, drill the holes and install blind nuts before epoxying the firewall in place.



■ **LEFT:** Use a thread tied to a pin in the tail end of the fuselage and stretched to opposite points on the wing exactly the same distance from the fuselage centerline to get the wing perfectly square with the framed-up fuselage before gluing the two together as a solid unit. ■ **CENTER:** The same trammeling technique, with the thread anchored to a pin in the nose, is used to get the stab perfectly aligned on the fuselage. ■ **RIGHT:** With the tail surfaces glued permanently in place, the upper fuselage turtledeck structure can be added.

plans. If you are using the contact cement method these pieces will stay right where you put them.

Once you are satisfied with the fit, glue it all together with thin CA. Now, pick it up, turn it over, and place another piece of wax

paper over the first built-up side. Build the second side right over the first. This will insure that they are as close to identical as possible. Once the sides are dry, carefully remove them from the building surface. Make certain that all glue joints are sound.

Glue the triangle stock to the inside top and bottom nose section. Install the backing for the firewall. (Did you notice that the engine offset is built in?) Turn the fuselage sides upside down, locate and install bulkhead F1 using CA glue. Prepare the firewall by drilling all holes and seating the blind nuts. Epoxy the firewall in place in the fuselage; put some epoxy around the blind nuts as well. Let everything set until the epoxy is completely cured.

Next, glue in the tank mounts, then install the tank with all tubing. Place a bit of foam between the back of the firewall and the front of the tank. This done, you can now add the top and bottom balsa nose blocks.

Place the flap control rod into the rear of the wing cut-out and slip the wing into the fuselage. Check that the wing is level tip to tip and that the fore/aft centerline lines up with the datum line. Once you're satisfied that everything is absolutely square, lightly glue the front part of the wing to the fuselage, up to the spars only. Connect the flap pushrod to the flap control rod as shown. Hook up the elevator pushrod and run the end through the aft fuselage opening. Place the assembled wing and fuselage over the top view. Carefully bring the tail pieces together, making sure that the fuselage stays lined up with the centerline. Keep the fuselage straight!

Cut, fit and glue the top and bottom cross and diagonal bracing in place. Use epoxy to permanently glue the wing in place. See how stiff the aft fuselage is?

Glue the vertical and horizontal stabilizers in place. If you have access to one, use a Robart incidence meter to check alignment. Otherwise measure, measure, and measure some more.

Install the turtledeck formers and all fuselage stringers. Glue the tail wheel mount in

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place. Add fillers behind the canopy area.

Prepare the plywood landing gear mount by drilling and tapping the four holes (#25 drill, 10-24 tap). Flow thin CA into the tapped holes. After the glue has set, run the tap through them again. Add the triangle stock supports to the inside fuselage sides, mount the gear to the plywood plate with two 10-24 nylon bolts, and epoxy the mount in place. After the epoxy has cured, remove the gear and rough-sand the fuselage to shape. Finish up with 220 grit.

Install all of the various parts, again checking all fits and alignments as you go. Check the weight and balance and adjust accordingly. Cut the canopy from a 14-inch Sig bubble canopy, but don't install it yet. If you are going to install cockpit detail and/or a pilot, now's the time to do it.

You can fillet the wing joint now, using your favorite method. Mine is lightweight spackling compound. I dry it completely with a heat gun so there's no moisture left to cause problems later. Sand the fillets and check the fuselage once again.

Cover the fuselage with your choice of covering—I like iron-ons. I start with the bottom first, working from back to front so that all laps are to the rear.

OK, the worst is done. Install the canopy with RC56 glue. Install the flaps, rudder and elevator. Trim the ship with that killer color scheme you've figured out. (I find it helps to use a color wheel for complementary layouts.) Use your imagination and have fun; just avoid the temptation to go overboard, as you can add too much weight. I really like the graphics that Vinylwrite made for me. Spray on a coat of clear polyurethane to seal the finish.

FLYING

Check the weight and balance. Make sure they really are where they should be. Place enough weight in the tip weight box to cause the outboard wing to drop slowly when balanced on the plane's fore/aft centerline. Make sure that all fittings are secure and adjust the handle for neutral.

Take it out and fly. Some flight trimming may be necessary. The best instructions I've ever seen on trimming were written by Paul Walker for an article in *Stunt News*, the PAMPA newsletter. (PAMPA stands for Precision Aerobatics Model Pilot Association.) This is an excellent organization that you should seriously consider joining. You can get a copy of Paul's article from PAMPA for a nominal fee. The information in it will really help you now and in the future.

CONCLUSION

I hope you enjoy building and flying this plane. It's not at the cutting edge of CL Stunt design; rather, it's a straightforward, basic ship with the potential to help those of us on the lower rungs work our way up through the beginner/advanced classes. It is designed for the low-time pilot/builder and is set up more like an RC plane than the typical CL stunter.

Since I began using a stock K&B .28



The author's latest Twister Sister was built with a removable wing so he could transport it in a subcompact car. This isn't detailed on the plan, but these photos should get the idea across, for those who may want to engineer a similar system.



Sportster, with its backplate radial mount, I've found that I don't have to beef up the nose like I would otherwise. Without the engine beams there is more latitude for tank mounting. I use a 4-ounce plastic RC tank on muffler pressure. With this combination and a 10x5 Rev-Up or APC prop at 10,000-11,500 rpm (depending on the prop), I get a smooth, almost tuned pipe-like run. The most common remarks I get after a flight are, "What engine are you running?" and "It's so quiet!"

The radial cowl really adds to the appearance of this airplane. It can easily be made from a 1-liter soda bottle; throw the heavy base away and use the bottom of the clear plastic bottle. Paint the inside with matching paint and mount it with standoffs.

Since I started this project, about a year and a half have passed, so I think some updating may be helpful. The original prototype with the standard wing has been re-

engineered with an O.S. .40 FP to better cope with conditions here at high altitude. The plane handles it quite well. The plane shown in the building sequences has had wingtips added to the longer wing, giving it about 70 more square inches to further lower the wing loading.

If you're really observant you may notice that the plane in the photos is a bit beefier under the wing. I built it with a removable wing because there is no other way I can get it into my Geo Metro. I also found that I could save 4 ounces by going to a wing-mounted landing gear. The plane in the photos has the capability of using either the fuselage-mounted aluminum gear or wing-mounted wire gear.

The Twister Sister has a lot going for it and can be a very capable flier. Several features are designed into it that, with practice, should see you scoring better and moving up the competition ladder. Good Luck! **MB**

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ENFORCER continued from page 49

stoppers." One of our club members has used this system on his own for over a year, and says flat out that the blades won't hit the tail boom unless they "fold" in the blade holders—which couldn't happen unless they were almost stopped, anyway. The soft damping of the Enforcer head makes it a smooth flying heli, but without the "boom strike stoppers," it does have a tendency toward boom strikes for beginners, or for experts who mess up an autorotation.

The instructions for the ZR have been both updated and expanded. The beginning of the instructions for each assembly identifies the tools you'll need, and which bag to open to get the hardware you'll need. I like the little metric scale at the bottom of each page, and the one-to-one scale drawings of the different screws and bolts used in the helicopter. There are also very specific instructions on setup, using actual pushrod lengths and ballpark settings for three of the JR radios. (I am using a Futaba Super 7 radio. You don't have to have a JR radio, though I do use a JR PCM-10 on my other helis.)

John Adams of Horizon did an excellent job of revising the instructions. I'm very conscious of how hard it is to explain things in text, because most of the writing I do is explaining complicated sections of the tax laws... not talking helicopters.

You'll see from the pictures that I have a tail boom support on my ZR. It's not included in the kit, but I think it good to have one on this helicopter. I was getting a little tail rotor shake that disappeared as soon as I put it on. There is one available from Horizon, but you can use almost any one—or make your own. (Mine is a TSK.)

The new Webra Redhead .32 is Horizon's latest heli engine. It's basically the original Webra .32 with a bigger carburetor. It starts easily and maintains an excellent low idle. I broke the engine in simply by running it rich for about 10 tanks. I had used the earlier version with good success on 15 percent nitro and a Magic Muffler tuned exhaust system. I have started to run all of my helicopters on Morgan 30 percent nitro fuel using mufflers only. The special Kalt Enforcer muffler is perfect for this, but I was concerned that the Webra might have a little too much compression for that fuel, so I added two additional head gaskets. The Webra seems to put out the most power at higher revs, so I've kept the blade pitch to around 8 degrees top end. I'm running about 1700 rpm at hover, and at least 1850 unloaded at top end in forward flight.

Remember that clutch I was telling you about that is so well made? It works as good as it looks. What I like best is that it doesn't engage too early.

Just as I figured, the stability of this helicopter is exceptional, and makes hovering fun—not just a beginning and an end to a flight with a lot of crank-and-bank in be-



■ **LEFT:** An example of the Enforcer's modular construction. Engine and drive train have been attached to the transmission assembly, which in turn drops right into the sideframes and landing gear. ■ **ABOVE:** An upside-down view of the assembled main rotor head. What would be the lower plates (here seen on top) are the "boom strike stoppers." They're identical to the regular damping plates, but they're not attached to the blade grips.

tween. The tail rotor is very strong, and nothing is lost in tail power with the extra length.

With the four-ply, tip-weighted blades and the new boom-strike stoppers as backup, I did five or six straight-down autorotations. There is plenty of stored-up

energy to allow a wide margin of error, and I was able to hover for a few seconds at the end of the auto before touching down. Since my helicopter was one of only a handful in the country at the time and no spare parts were available, I confined my aerobatics to a few basic loops and rolls.

There is plenty of control power for tight loops and quick rolls—if that's what you like. I prefer big loops and slow rolls, letting it hang inverted for a couple seconds. I'm running plus and minus 8 degrees pitch with a U-shaped throttle curve, and I've still got room for another 8 or 9 degrees of pitch if I want it.

There's no pitch-up tendency in forward flight, even into fairly gusty winds. The new rotor blade design with the raked tip, and the smaller flybar paddle with the feathering point moved forward helps makes this possible.

At this point, whatever reason I ever thought I had to get one of the new "roarin' 60s" is out the window. I'm a firm believer in the smaller, quieter, 20-flights-per-gallon, .30-size helicopters. And I like this new Enforcer. A lot!

What don't I like? I don't like the name "Enforcer." I live in Chicago, and that word is used to describe a mobster who beats up and terrorizes people. This heli makes people happy. It brings smiles to their faces. Couldn't they think of a better name? For example, what's wrong with "Harold"? **MB**



■ **FAR LEFT:** Orbiting gears attach to the autorotation housing. Makes for a very smooth rotation with no side load on the gear or autorotation bearings. ■ **CENTER:** The quality of the clutch, clutch bell and fan are such that the author found them to run perfectly true, no dial indicating required. ■ **LEFT:** The engine used in the Enforcer 2R review was the new Webra .32 Redhead, also distributed by Horizon. It retains the features of the previous .32 bell engine but has a bigger-bore carb for more power. The engine is pictured with the stock Kalt cooling fan and an aftermarket one-way starter cone produced by Vortex R/C Helicopters.

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PLUG SPARKS continued from page 60

control demonstration team. Needless to say, years later, Palmer was inducted into the AMA Hall Of Fame.

ENGINE OF THE MONTH

This month we feature the little-known Vivell Twin .40. Most collectors are familiar with the .60-size versions, so this smaller type should come as no surprise. We don't have much information and/or specifications on the .40, but suffice to say the engine is built and performs like its bigger brother.

The name Vivell is a very old one. This writer remembers living in San Francisco and walking from 3rd Ave. to 18th Ave. on Geary St., where Vivell's hobby shop was.

Up to 1929, I had been building only solid scale models. I inquired about a flying model to build, and for the princely sum of 50 cents, I acquired an R.O.G. kit with all the parts. Needless to say, the model didn't last long in the windy San Francisco bay area.

Later, Earl Vivell got into the wholesale model distributing business to augment the hobby shop income. At this time (1936-39), there were four major hobby shops in San Francisco plus a few small ones on the outskirts.

Vivell's travels as a wholesaler for model airplane items took him all over the bay area. It was only a matter of time before he ran into Jack Keener, a model engine manufacturer who had recently moved from Los Angeles, where he had produced the Dreadnaught and several other engines.

At this time, Keener had contracted with the Comet Model Airplane Company to design and produce a .35-size engine that would be compatible with Carl Goldberg's sensational Zipper. Comet had everything in its Zipper kit necessary to build and fly the model—wheels, prop, glue, etc. The only thing missing was a good reliable engine. The result was the Comet .35, which Keener developed and manufactured.

In conversations with Jack Keener, he indicated that relations were quite good with Comet. He received all sorts of praise for his engines, the quality of workmanship and the ability to meet the demand. But Keener ran into cash flow problems—more money going out than coming in—and eventually relations broke down.

This was an excellent opportunity for Earl Vivell. He had all of the remaining complete engines on hand marked "Vivell" and proceeded to sell them during wartime restrictions on critical materials, advertising them under the guise of "a few engines left."

After the war, entrepreneur Vivell had Keener develop the Super Vivell, followed by a flock of other size engines. The small diesels were of special interest, as were the twin .60 and .40 engines. Vivell was a real hustling salesman and for years placed his engines in all of the leading hobby shops.



Photo No. 7. Frank Womack, SAM 21 V.P., turned up at a SAM 21 meeting at John Pond's plan shop with a gorgeous 1/2A Ford 2T, forerunner of the Trimotors.



Photo No. 8. Joe Elgin built this 1939 Korda beauty for Dick Korda to fly at the upcoming Dick Korda Commemorative, sponsored by SAM 39. Joe will see to it that Dick flies competitively!

One night in the late '70s, Earl Vivell came home exhausted from a tough day of selling and sat down in his favorite chair to await the call for dinner. He never answered the call.

1/2A TEXACO SCALE

Peter Van Dore of SAM 76 wrote to say that the 1/2A Texaco Scale event is very popular on the East Coast and keeps growing all the time. Photo No. 6 shows his latest effort, a Douglas Y10-43 powered by a Cox Texaco .049. Pete scaled the model to 238 square inches from an old Comet plan.

The model was carefully painted to the

U.S. Army color scheme; wings and tail of yellow transparent Micafilm and a fuselage painted with Aerogloss olive drab. To round out the detail, hand-carved pilots were added to create realism. We need more stuff like this!

MORE OF THE SAME

While discussing 1/2A Texaco Scale models, Frank Womack, V.P. of SAM 21, showed up at a club meeting with his latest project (Photo No. 7), a Ford 2T, one of Ford's first airliners as designed by William Stout. Take off that in-line engine and substitute a Pratt & Whitney radial engine and you have the forerunner of the Ford

Trimotor, aka "Tin Goose."

DICK KORDA COMMEMORATIVE

Hard on the heels of their very successful Lanzo Memorial Contest, SAM 39 now announces a meet dedicated to Dick Korda. This will be held on August 18-19, at Shelby, Ohio.

Joe Elgin was kind enough to send photo No. 8, a 1939 Korda Wakefield, which he built. Hopefully, Joe will be able to prevail on Dick to fly the model. Joe is quite enthusiastic about this meet and predicts that 10 or 15 replicas of Korda's Wakefield will show up. A great way to honor a famous modeler! **MB**

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MODEL DESIGN cont. from page 36

2) Panasonic talks about trickle charging rates between .034C and .05C but does not seem to say what happens if we continue to charge at the .1C rate.

3) Sanyo (Cadnica) talks about trickle charging between .02C and .05C and says, "When charged at a current level higher than .05C, overcharging occurs, causing deterioration of cell performance and leakage." The "deterioration of cell performance" mentioned is probably the voltage depression we have previously discussed. Leakage (gas venting) will always occur if the overcharge rate is high enough, but venting would require a continuous charging rate of way over .1C.

4) Page 20 of Varta's Technical Handbook says, "Maximum permissible trickle charge

current = .1C" (ah-ha!), but "recommended max = .05C" (oh-oh). "A trickle charge current between .03C and .05C is recommended. At these charge rates a life of 4-6 years is to be expected. At the maximum permissible trickle charge current of .1C a reduction in battery life is to be expected."

I also received a letter from John G. Smith of Columbia City, Indiana. John is a Scientific Leader Member of the AMA and has extensive experience in using NiCd's in military design applications. John's letter and the material he enclosed agreed well with Albert Tejera and with the material Jim Smith found for us.

Part of the differences between the statements of the various NiCd manufacturers may stem from physical differences between their batteries, but I suspect that some of the differences also stem from the amount and

type of testing each company has done, and from marketing thoughts.

So if we continuously charge at the standard .1C rate we will probably reduce the life of the battery somewhat, and if we trickle at too low a rate we can't have quite the full capacity of the battery; but the acceptable trickle-current range is comfortably broad in all of the manufacturers' literature I have seen.

The cooler NiCd's are kept, the longer they will last. High temperatures cause cell deterioration. High overcharge rates not only increase the cell temperatures but increase the internal gas pressures. John Smith made a good point in an article he wrote for the Whitley County (Indiana) Barnstormers newsletter. Quoting John: "When the battery is low and being charged at the 1/10 rate, most of the energy goes to recharge the battery;

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once fully charged, the energy goes to heat" (and gas generation).

The hotter a battery, the more you should be concerned with possibly excessive charge rates and times. Note that the battery temperature will be determined by a combination of the external temperature, the charge rate and charge level, the discharge rate (in the case of the electric power guys), and also the insulation around the battery. If the metal cases of the cells were left uncovered they could dissipate internal heat more easily. If they are wrapped in foam (an excellent thermal insulator) and tucked away in a further insulating fuselage, be more careful. If you live in a hot climate, be doubly careful.

If we don't trickle charge at all, we don't hurt the batteries, because, unlike lead-acid batteries, NiCds can be stored discharged indefinitely. Dan Parsons in New Mexico recently told me about an experience of his. He ran across a NiCd battery that had been sitting discharged for 26 years (an old eight-cell reed receiver pack). Out of curiosity, he charged it up and tested it. The capacity was still very good! Don't count on yours lasting that long, though.

If we don't trickle charge, we have to keep track of and worry about whether we need to charge before we fly tomorrow. For years I would fly for several sessions without recharging—with plenty of testing in between, of course. I got careless and crashed one airplane using that system.

Jim Smith heard of fellows who hook up their .1C chargers to a cheap 24-hour timer and let it turn on the chargers for an hour or two per day. I'm using that system now too.

At the time I wrote the April column I took all of my NiCd batteries off their trickle chargers and put them on standard chargers full time. Now I have put them back on the trickle chargers or timers. I had no battery failures during this period, and don't expect any, but I may have reduced the battery life by a little.

After the December issue, where I recommended trickle charging, I received a lot of letters and phone calls asking me what series resistor to use to convert some specific charger into a trickle charger. I wasn't able to help most of those people, since I could not conduct tests on their particular chargers. As I wrote in December, a lot more than Ohm's law is needed in these cases. If you have a meter which will measure milliamperes, you can select a resistor by trial and error to put the trickle current in the .025-.05C range. If not, either buy a digital multimeter and play, or go to commercial trickle chargers—or remember to charge.

All of the above had been written before I heard from two more gentlemen. Dick Kidd, friend and Technical Editor of RCM, after reading my column that started all of this, wrote me a note, and also had Red Scholefield write to me. C.L. "Red" Scholefield had written a couple of good articles on NiCds in

RCM back in 1990 and 1991, and some recent ones too. Red also happens to be Manager of Technical Marketing for Gates Energy Products; Red was the manager of the group which wrote the G.E. Ni-Cd Handbook which led me to disconnect my trickle chargers! Now we are getting somewhere. Guess what Red says? Paraphrasing and shortening what he wrote:

Overcharging shortens the life of NiCds regardless of the manufacturer. He hazards the guess that continuous overcharge at C/10 would shorten the life by as little as 10 percent and no higher than 20 percent. The G.E. handbook was written for dustbuster and electric shaver NiCd use, and does not address the fine points of life that modelers may be interested in. Trickle charging at C/30 to C/40 is good. Intermittent charging is better yet, as it reduces cadmium migration shorts through the separators. About an hour a day at C/10 will do very well. Heat kills batteries.

So everyone agrees. Keep cool, and trickle, pulse, or intermittent charge. My thanks to all who helped.

P.S: If your wife bugs you about wasting electricity by leaving your chargers on, tell her what I found by running some input AC current tests: If your power costs 10 cents/kwh, it will cost about one cent per month total to charge both flight and transmitter batteries one hour per day. Trickle charging is more extravagant; you may not want to tell

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her that leaving the same two batteries on trickle continuously will cost 14 cents per month.

THE AMAZING AEROBIE

Rocks, baseballs, Frisbees, hand-launched gliders, javelins, boomerangs, and the discus are all hand-thrown things. In many cases the objective is to see how far we can throw them. Considering all of these throwables, which can be thrown the farthest? None of the above! The answer is the "Aerobie," the device shown in the photo.

I've had several Aerobies in the last five years or so. It is a recent invention, patented only about seven years ago.

I didn't find any distance figures for boomerang, ball or glider throwing, but the world record for the discus is over 220 feet, and for the javelin it is over 300 feet. A good throw in one class of Wham-O Frisbee competition is 190 feet. The record throw for the Aerobie is 1,257 feet! Aerobies have been thrown across Niagara Falls, across the Potomac, and across the Thames River at London.

As you can guess from the photo, the Aerobie is an aerodynamic device. It was designed by an engineer who is a lecturer at Stanford University. The Frisbee could be compared to a tailless glider with an aspect ratio of 1, while the Aerobie could be compared to a tandem-wing glider with a high aspect ratio. So the Aerobie is not only more stable than the Frisbee and its clones, but it has a much higher lift-to-drag ratio. The Aerobie, like the Frisbee, is normally thrown backhand with a snap of the wrist to provide a lot of spin for gyroscopic stability.

The design of the airfoil on the Aerobie was an interesting challenge. Since the aerodynamic surface curves around in a circle, the air is flowing across the airfoil of the leading half or "wing" in one direction and flows over the "tail" airfoil in the oppo-

site direction. Because of the reversal of the flow across the trailing airfoil, one might expect the foil to be symmetrical fore and aft, but it isn't. Either analysis or experimentation, or both, led to an interesting raised lip on the outside of the ring, and a sharp trailing edge (the leading edge of the "tail") on the inside of the ring.

The designer's object was to develop a device that would fly perfectly straight for great distances, and he succeeded. If the Aerobie is thrown with a tilt to either side it will turn, but thrown flat, it stays flat and straight. If it does turn a little one way from a perfect throw it can be readjusted to remove the turn. It can be thrown at a low angle of attack to maintain the altitude at which it was launched, or at a higher angle of attack to make it climb.

For further information on the theory and design of the Aerobie, read the two U.S. patents that were granted on it: patent numbers 4,560,358, and 4,456,265. You can get copies of any United States patents by sending the patent numbers and \$3.00 per copy to the United States Patent and Trademark Office, Washington, D.C. 20231.

Frisbee flingers and glider chackers will love the Aerobie. Its performance is amazing. Playing catch with someone who is the length of a football field away from you is a new experience. Look for Aerobies in the gift shops at science museums, sports stores, and wherever you would look for Frisbees. The Aerobie company also sells a triangular-planform Aerobie designed to come back like a boomerang, but the round distance-throwing model is the amazing one. It comes in two sizes. Get the larger one.

PARTING WORDS

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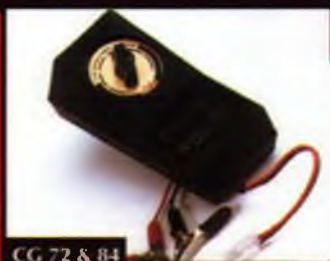
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