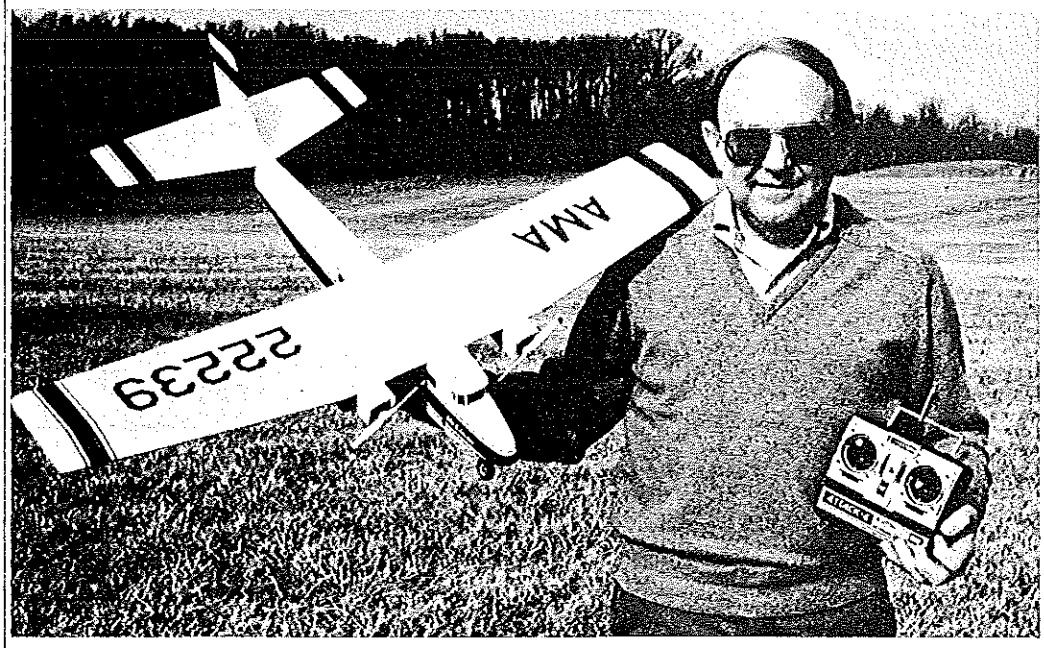
the HILINER

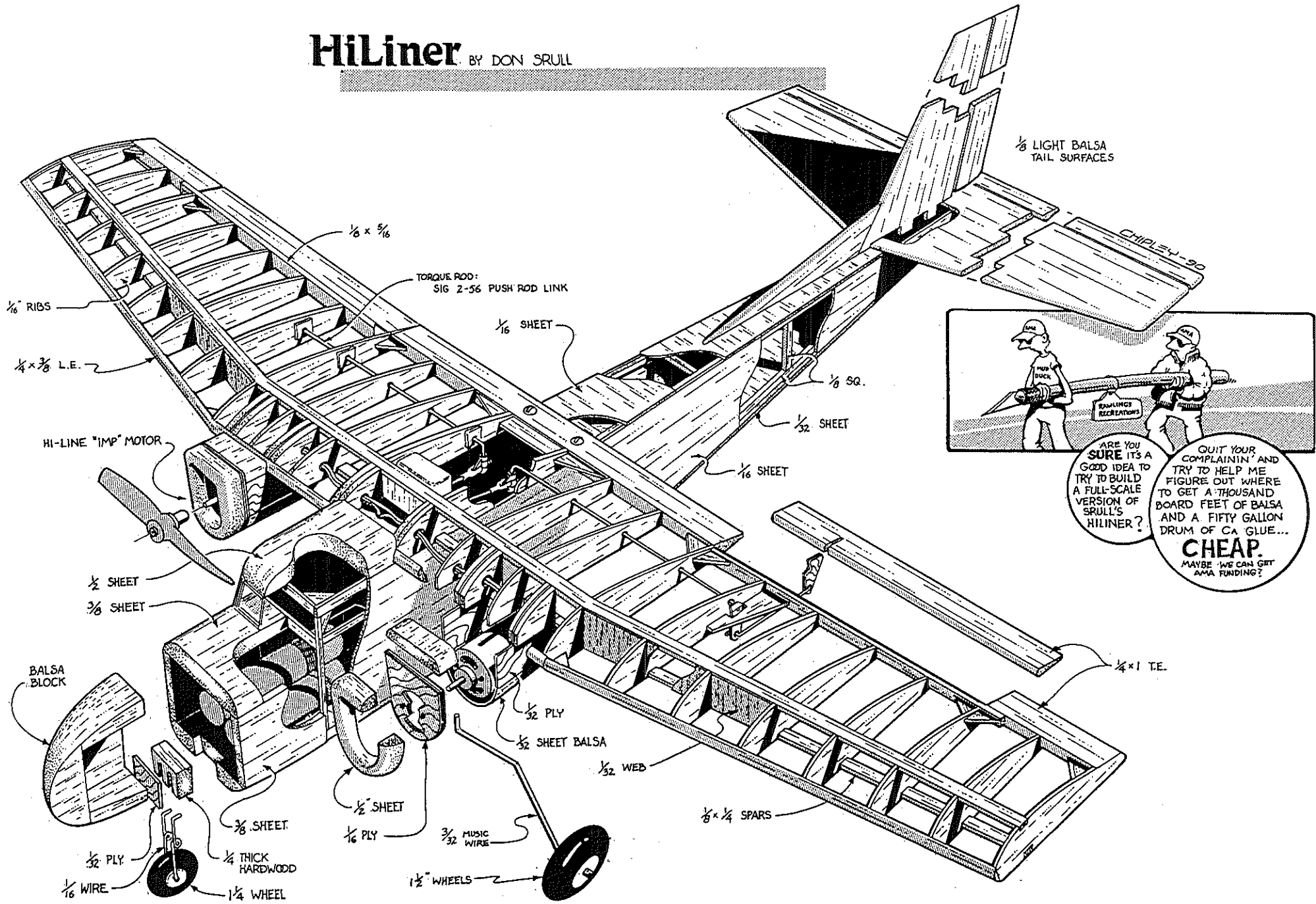
THE ADVENT of practical electric power for sport RC flying has made designing and building multi-motor models a much simpler chore. Compared to the difficult problems created by glow-powered models, the average sport flier has a much better chance for success when using electric power. There are two basic reasons for this—the easy, almost automatic synchronization of multiple electric motors, and the virtually perfect throttle response provided by the modern Mosfet electric motor speed controllers. Now with the recent introduction of small and inexpensive electric motors, such as the HiLine IMP-30, sport fliers have an entirely new ball game to enjoy—compact, economical and good-flying multi-engine sport models, including scale.

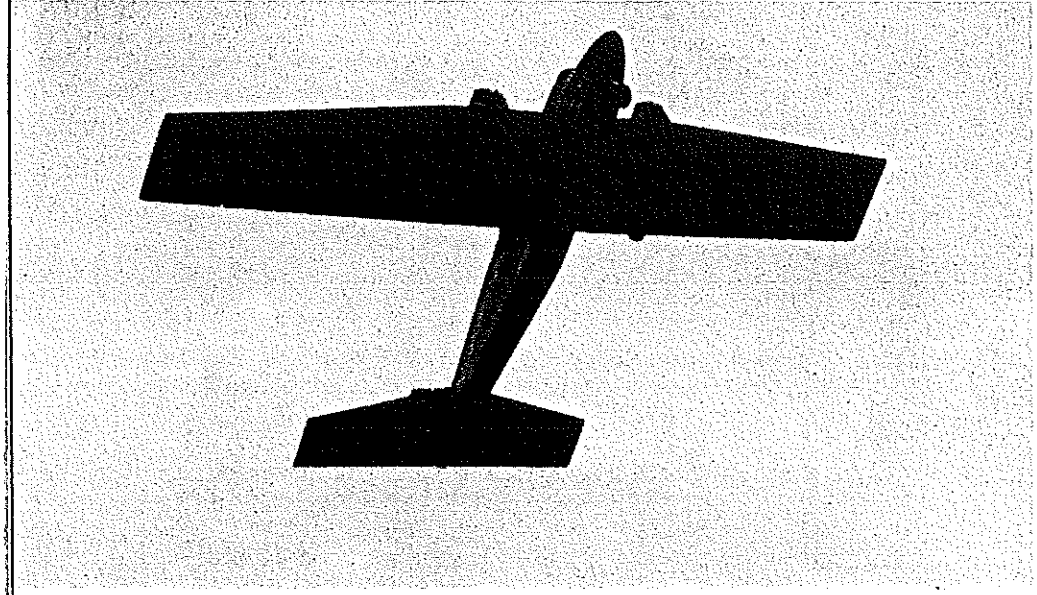


Top picture: The completed model up close. A semiscale rendition of an executive transport, the HiLiner epitomizes the advantages of electric power for RC sport flying. And wait till you discover the delicious pleasures of perfect and full throttle control! Above: The author holding his creation. The Futaba 4NBL/MRC four-channel radio system has its own speed control. Plane both looks and sounds realistic in the air, is a supple, honest flier.

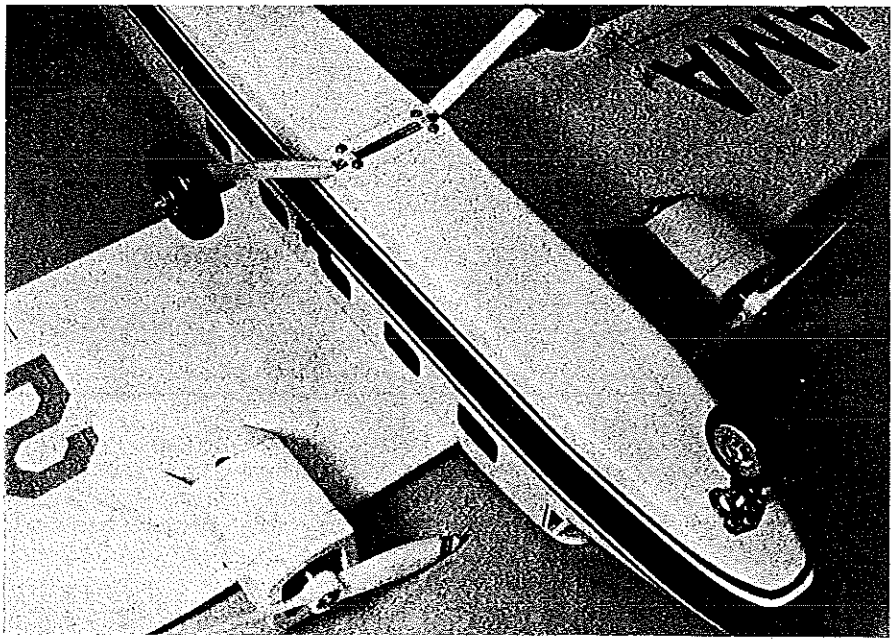
Electric RC sport flying just got easier. Designed for twin HiLine Imp-30 motors, this simple little semiscale transport plane behaves like a lady and tracks like an arrow. But what else would you expect from full and perfect throttle control? ■Don Srull

HiLiner BY DON SRULL

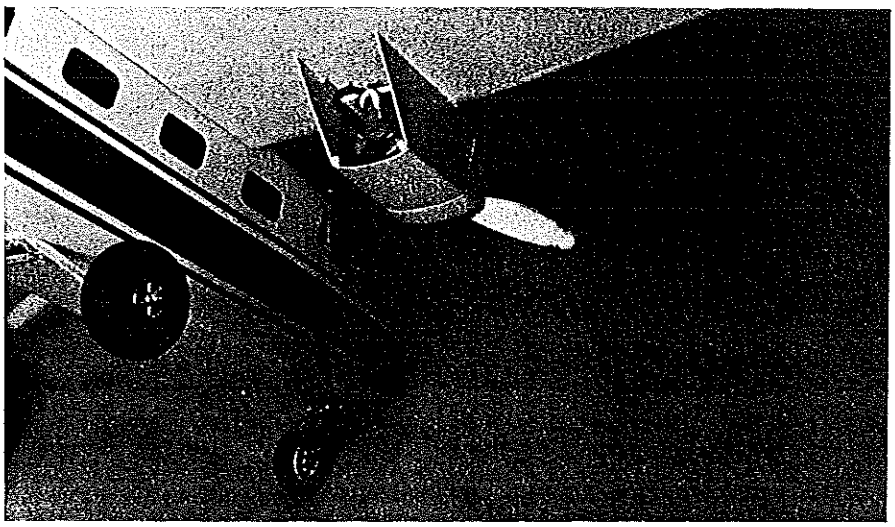




The HILiner aloft. The model's full-house, four-channel control gives precise, smooth flying, while the counter-rotating props seem to eliminate all torque effects.



The underbelly of the airplane showing trike-gear arrangement with torsion bar landing gear. Torsion bar gear operate independently for better distribution of impact shock, are easy to disassemble. Music wire gear fit inside the bars. Note counter-rotating propellers.



This view of the nacelle shows the simplicity of the motor installation. Note the noise suppression capacitor soldered across the motor terminals.

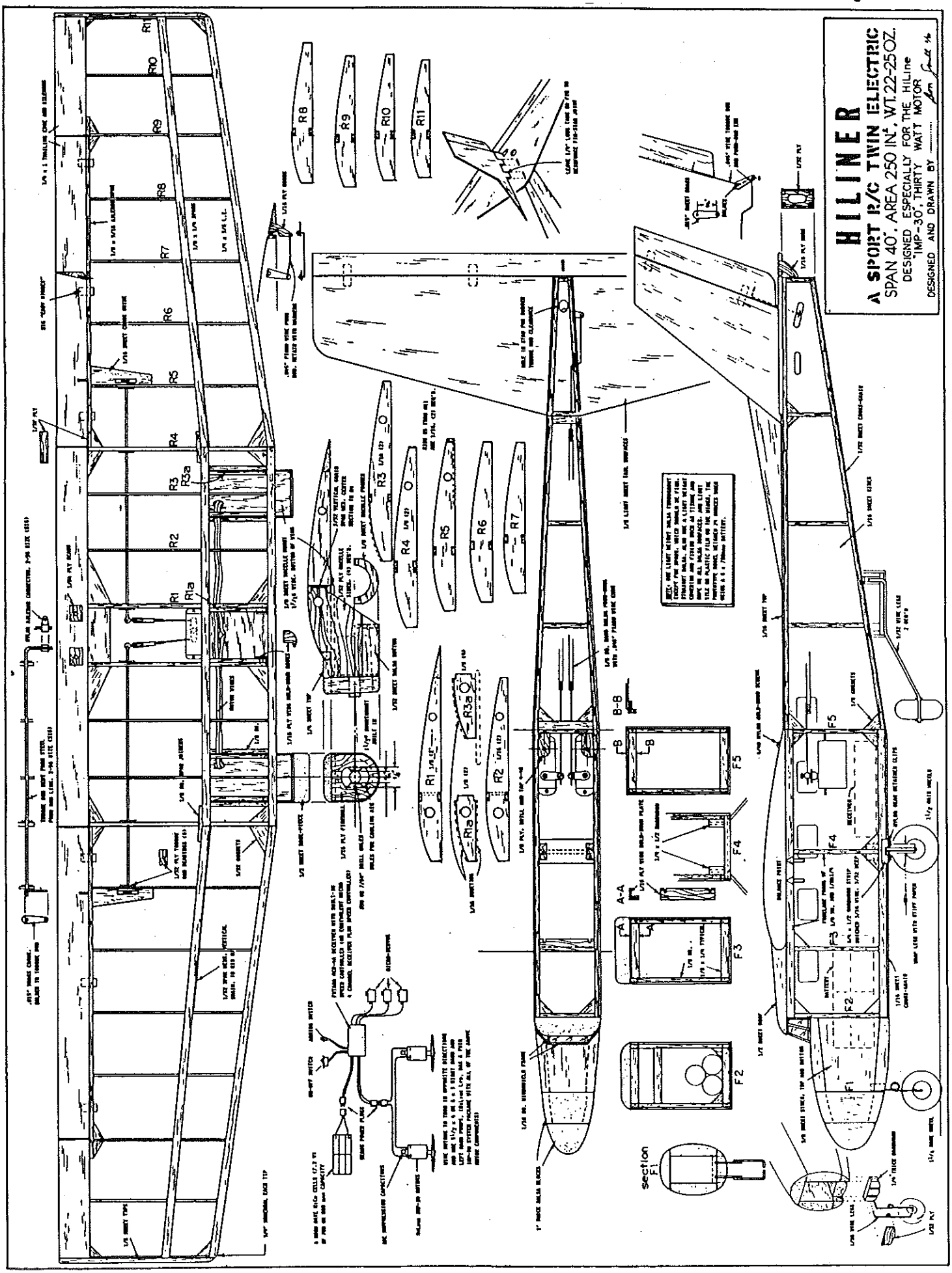
To learn a little more about this new class of sport flier, we set out to design a small and simple twin-motored model especially sized for the HiLine IMP-30. The wing area was set at 250 sq. in., with a span of 40 in. and a target gross weight of 20 to 25 oz. A stable shoulder wing configuration was selected, as well as easy sheet-balsa fuselage and tail construction. With a trike gear sketched in on the early design doodles, we soon had a sleek-looking semi-scale version of an executive transport a la Aerocommander.

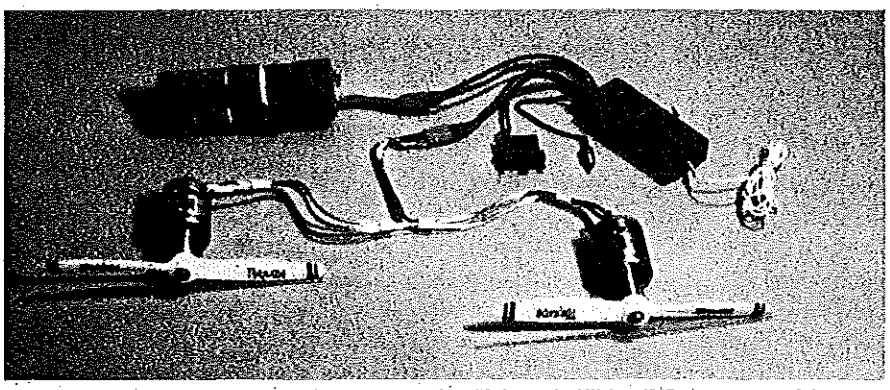
The model has the IMP-30 motors turning 5½ x 4 props in opposite directions to eliminate any torque effects. One nice feature of these little motors is that they run on only three cells. Wired in series, therefore, the two motors require a six-cell battery of 700mAh to 800mAh capacity. (More on the battery choices later.)

The common six-cell battery packs used are readily available and are easy to charge with almost any of the simple field chargers available today. The six cell arrangement also allows use of the new and very convenient Futaba 4NBL/MRC four-channel radio system, which has an electric motor speed control built into its receiver. The receiver also has a battery eliminator circuit (BEC) built in, which means the radio system works off of the motor battery and does not require its own four-cell battery pack. Several other very good mini four-channel radios are also suitable for compact Electric models, including the Airtronics VG4R system. A separate speed control has to be added, of course, when radios without a built-in speed control are used.

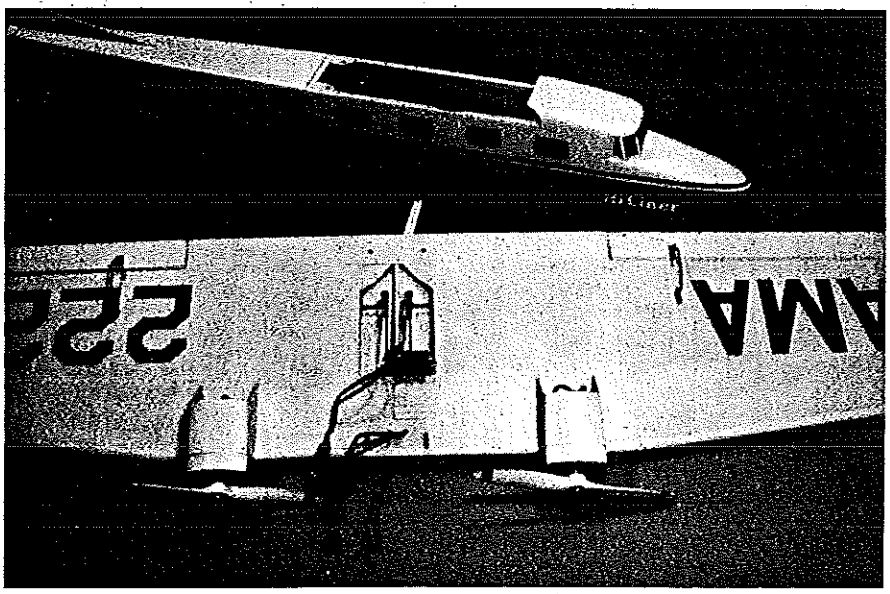
The bottom line is that the little HiLiner flies great and looks and sounds very realistic in the air. Its full-house, four-channel control allows very precise and smooth flying, while the counter-rotating props seem to eliminate any and all torque effects. And talk about throttle response! How about zero to full rpm, and everything in between while on the ground or in the air? It's a real pleasure and a big help to fly with perfect and full throttle control; something unheard of for compact sport models not very long ago. If you want to give this new kind of multi-engine flying a try, I think you'll like the HiLiner. So let's get building.

Structure. The HiLiner uses pretty simple and standard construction methods. The one caution that must be taken to assure a good flying model is to build light. Use lightweight balsa throughout as indicated on the plans. Do not beef up or add structure to the model. As designed, it is much stronger than actually required. If you have any ideas for saving weight, I would encourage you to try those. Keep the covering and finish to a minimum; light plastic film covering, for example, will work fine. Even painted finishes, as described later, can be kept quite light. Keep in mind that any weight saved in the airframe will increase the performance and endurance of any Electric model. And since the Ni-Cd motor battery is our only source of propulsion energy, we can't skimp on battery weight. Re-


HILINER
A SPORT R/C TWIN ELECTRIC
SPAN 40", AREA 250 IN², WT 22-25 OZ.
DESIGNED ESPECIALLY FOR THE HiLine
"IMP-30", THIRTY WATT MOTOR
DESIGNED AND DRAWN BY



What makes the HILiner go. Note the compact size of the twin HILine IMP-30 motors. A battery eliminator circuit (BEC) in the receiver of the Futaba 4NBL/MRC four-channel radio system (at right) allows the six-cell battery pack (seen on the left) to drive both the motor and radio. Another advantage is the receiver's built-in electric speed control.



A single servo, shown here mounted in the wing, operates both ailerons.

member, to achieve any reasonable endurance, an Electric model has to carry about 25 percent or more of its gross weight in the form of flight batteries.

Fuselage. Start the fuselage construction by building two identical sides, using ⅛ in. square and ⅛ x ¼ in. balsa strip. Attach the 1/16 light sheet-balsa sides to these frames. Since the sides are about 3¼ in. wide at the forward end, if you are using 3-in. wide balsa sheets, you will have to glue small strips onto these sheets to increase their width. Next, join the sides with cross pieces and gussets, making sure the sides are lined up properly and kept rectangular. The ⅜ in.

The sleek, stylish lines of executive transport planes like the Britten Norman Islander, seen here in replica, provided inspiration for the HILiner.

sheet balsa nose pieces can now be cut and glued to the fuselage along with the two 1-in.-thick nose blocks. Only tack glue the nose block pieces in place.

After carving and sanding the forward fuselage to shape, the nose blocks are removed and the hardwood nose gear mounting plug is cut, shaped and fitted as detailed on the plan. Bend the two nose gear legs from 1/16 wire, and when all parts are checked for proper fit, reglue the nose block in place, minus the front mounting block and gear struts. It will be easier to add the nose landing gear after the fuselage is final sanded and finished.

The cabin roof block is now rough cut from soft ½-in. balsa and temporarily attached to the fuselage top. Final shaping and sanding will be done after the wing is completed and fit to the fuselage. Bend and fit the two 3/32 wire main landing gear legs to the fuselage bottom with the two nylon landing gear clips. When the fit is satisfactory remove the gear and set it aside also.

Cut the tail surfaces from straight, light weight ⅛ sheet balsa. Sand and attach the 1/16 ply horn to the elevator. Cut the rudder horn from .015 sheet brass and bend the torque rod from .045 wire. Solder the horn to the torque rod and glue the assembly to the rudder. Make sure the tail surfaces will mate correctly to the fuselage, and set them aside until covering and assembly.

Wing. The first step is to cut out all of the wing ribs from 1/16 and ⅛ in. balsa. Cut the aileron torque rod and motor wire cable clearance holes with pieces of sharpened brass tubing. While framing up the wing over the plans, do note that the ¼ x 1-in. trailing edge stock is for both the trailing edge and the ailerons. Here is a tip that will save time later on: Thread the aileron torque rods and their 1/32 ply bearings through ribs R1 to R5 while framing the wing over the plans. The torque rod is bent from a piece of steel push-rod link as shown on the plans. Use the small size link which has 2-56 threads on one end (available from Sig or Goldberg Models). If you try to insert these rods after the wing framework is complete, you will have to cut up the ribs to get them in. When gluing the ribs in place, be extra careful to align the four R3a nose ribs accurately, since they will determine the location and alignment of the two motor nacelles.

After the tip dihedral has been added and the top spars are in place, remove the wing and build the two motor nacelles onto it. First glue the ⅛ in. sheet balsa stabs to the bottom of ribs R3a, then attach the 1/32 ply nacelle sides and the 1/16 ply firewalls. Finally, attach the 1/32 balsa bottom, and the top and cowl balsa blocks, then sand the nacelles to shape. Complete the wing structure by adding the 1/16 sheeting between ribs R1 and ribs R3a forward of the spar. Also, make sure you have included the 3/32 and 1/32 balsa shear webs between the upper and lower spars out to rib R7. This adds very little weight but increases the wing strength tremendously.

It's time to install and check out the motor system. First give both IMP-30 motors the nominal break-in runs as recommended in the instructions that accompany the motors. The one to two hours of running does not fully break in the motors (this takes more like 10 to 15 hours) but will get them running very smoothly and efficiently—plenty good enough to start flying and having fun.

The break-in is done without a prop attached and at 1½ to 2 amps; two Ni-Cd cells can be used to obtain this current. The motors must be broken in in the correct direction, so you will have to decide if you want counter-rotating props or not. Either way will work just fine. I used counter-rotating props on my model because I had never tried that before; the right motor used the right hand (i.e. conventional) prop, and the left motor used the left hand one. Either combination here will also work OK.

After break-in, mount the motors in the nacelles using the 3-48 screws provided with the motors. Refer to the wiring diagram on the plans, and install the motor wires in the wing. Cut the wires to convenient lengths, and solder them to the motor terminals, making sure the polarity is correct so you get the proper direction of rotation. At this time also solder the arc suppression capacitors across the motor terminals. Add

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Music wire: .015
Prop hanger: .015 x .32 drilled for wire size, bound with light thread and coated with Ambroid.
Landing gear: 1/32 x 1/32 bamboo with cross-piece
Prop shaft and tail hook: .015 music wire
Covering: light tissue
Rubber: 1/32 x 1/32 Pirelli

HiLiner/Srull

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your favorite connector to the end of the cable that exits from the wing into the fuselage. The new Deans Power Plug (sold by ACE R/C and HiLine Ltd.) seems to be a very compact and efficient connector, just perfect for small electric RC use. Attach both props, either 5½ x 4s or 6 x 3s, to the motors, and give them a test run to make sure everything is OK. Don't overdo the test running on fully-charged batteries since the current draw will be higher than in flight (it should be between 10 and 11½ amps), and the cooling is not as good as it will be in the air.

Radio system. First coat the inside of the fuselage sides with epoxy in the area where the two miniservos for rudder and elevator will be located. This will harden and smooth out the balsa, providing a good surface for the double-sided foam tape that will be used to mount the servos. Make up the two pushrods from hard 1/8 in. square balsa and .045 wire. Install the aileron servo up against the rear of the main spar using double-sided foam tape, and make up the short pushrods that attach to the 2-56 threaded nylon servo connectors. The aileron bellcranks are cut from .015 sheet brass, drilled and soldered to the torque rods.

Align the torque rods and bellcranks, and tack glue the 1/32 ply torque rod bearings onto the appropriate ribs. Take care not to get glue inside the bearing holes! Make sure the aileron controls work smoothly and properly. Temporarily hook up the radio, charge the batteries and test the whole system, including the motors. If all is OK we are ready for covering and assembly.

Covering and finishing. Use your favorite covering method, but keep it light. Any of the plastic films will work fine. Since I prefer a painted finish on my models, I covered all balsa surfaces with light tissue (Plyspan) after brushing a few coats of nitrate dope on the bare wood. The wing was then covered with light silk (or if you prefer, clear Micafilm is a good, lightweight substitute). All surfaces were then sealed with two thin coats of clear nitrate dope. Before color doping, the tail surfaces are glued in place, and the hinged control surfaces are attached. I highly recommend Sig (RC)'s new Easy Hinges. For small models like the HiLiner, they are very easy to install and do the job nicely. I cut the hinge pieces into ¼-in.-wide strips to make installation simpler and to get better flexibility than full width hinges would provide. After assembly is complete, airbrush on a couple of thin coats of Dianna Cream butyrate dope overall. When dry, the trim stripes were masked off and a thin coat of metallic green dope was airbrushed on. A few pieces of ⅛-in.-wide red trim tape provided the final touch to a very light painted finish.

Flying. Let's first discuss batteries. As the saying goes, there are batteries, and then there are batteries. I can't emphasize too much the importance of good, properly-sized flight batteries. There is no other way to get decent flight performance out of Electric RC (or Free Flight) models. Old batteries from worn out radio gear or second

hand or surplus batteries of unknown origin are not worth fooling with. And it just won't work to make up for an overweight airframe by saving on battery weight. To help you get off on the right track, here are two specific batteries that are sized right for twin IMP-30 models, and that I know will work very well: A six-cell Sanyo 700AR pack weighs six ounces and will give full power-on flight times of four to five minutes; a six-cell Sanyo 800AR battery pack weighs 6.9 ounces and will give full power-on times of five to six minutes. The Sanyo AR-type cells are high rate, low internal resistance cells made for very high current applications like Electric models. They are rugged, easy to charge, and will last a long time if properly taken care of. If you are a relative beginner in Electric flying, I recommend you start with either of these packs. Later, you can explore other sizes and types of batteries, but these will be a good point of departure.

To help you get started in small twin Electrics, HiLine Ltd. is temporarily offering a twin IMP-30 system package at a price of $64.95 plus $5.00 postage and handling. It includes two motors, a Sanyo 800AR six-cell battery pack, two Deans Power Connector sets, two 5½ x 4 props (for counter-rotation), switch, suppression capacitors, and hook-up wire. It's seven bucks under the usual price and can save you time searching out all the right parts. Write HiLine at P.O. Box 1283, Bethesda, MD 20827.

Before test flying begins, make a few last-minute checks. If there are any warps in the flying surfaces, get them out by steaming or applying heat with a MonoKote iron. I would also recommend trimming both ailerons with about $\frac{3}{32}$ in. of *up*. This provides some effective washout in the wing helping to reduce tip stall tendencies. Check the balance point and shift the batteries as necessary to get it in the range shown on the plans.

If at all possible, try the first test flights by taking off from a flat, smooth surface. Our first flights were from a blacktop access road near a parking lot. Make sure control movement is in the correct direction and that the model tracks straight under power. When all seems well, slowly bring up full throttle and

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let the little HiLiner accelerate, using rudder to keep it tracking straight. Feed in a very small amount of *up* elevator, and let her take off when she's ready.

Keep it in a shallow, fast climb. Above all, don't try to horse the model off the ground early or let it climb out at a steep angle with nose high and airspeed low. Keep the speed up and let the model climb up to 100 feet or so before feeling it out. Correct any yawing tendencies with rudder trim and any roll with aileron trim. Set the elevator trim so that at high cruise speed the model shows no climbing or diving tendencies. With the center of gravity in the right spot the HiLiner should behave like a lady and track like an arrow. After gaining some altitude, throttle back and test its low-speed behavior. At full throttle, try some modest maneuvers like loops and wingovers. If you are using a radio with BEC, remember to think ahead. As the power begins to diminish, the automatic motor shut off will be approaching. You can soon learn to gauge how long a flight you can expect to make with a fully-charged battery pack and still come back in with power before the automatic shut off occurs.

I think you will enjoy the HiLiner if you give it a try. Just keep the total weight below 25 ounces, and you will be able to experience simple, practical and highly reliable multi-engine flying. On top of all that, the HiLiner is quiet, greaseless and economical. Careful, though. It may be habit forming.

RC Pylon Racing/Hager

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Sounds great! I'll pass more info along as I receive it.

RCACF Quarter-Midget Cash Dash: Bill Williamson sent in this contest report written by Dianna Knox:

RCACF Quarter-Midget Cash Dash
May 1990
Apopke, Florida

"Early in the morning on May 19, you could already hear the whine of Midget engines running and see the carbon fiber dust flying as props were whittled down to perfection. With $1,000 on the line, everyone wanted to make sure they had the advantage. As soon as CD Bill Williamson finished his pilots' meeting by reminding everyone to 'be gentlemen when discussing any controversies on the line,' it was down to hard-and-fast racing. When the matrix for round one was read, all 19 of the pilots realized that there would be no 'gimmies' during this contest.

"Everyone was amazed at the low rate of attrition and the fact that there had been no reflys. It was quickly proving that it wasn't necessarily the fastest plane but the most consistent one that would win.

" After about a one-hour rain delay in the afternoon, everyone was quickly back on the line to finish up round five. At the end of the day Jake Jacobson was out in front with 18 points, closely followed by Rick Landers with 17 and Jim Katz and Greg Doe with 16 each. The remainder of the field was in hot pursuit.

"The matrix was reshuffled for Sunday so that 'everybody could race everybody,' and everyone was soon back to the line for another exciting day. There were only two reflys during the entire weekend of racing, thanks mainly to an experienced group of course workers. The only two midairs occurred on takeoff, and neither appeared to be a fatality.

"Greg Doe and Jake Jacobson each had 35 points at the end of 10 rounds and had to fly off for first place. They put on a great show. When the checkered flag dropped, Jake was the winner.

"A drawing of donated prizes including everything from fuel to kits (of which there were several) was held for all the pilots. As soon as the drawing was completed Paul Benezra was presented with the Fast Time trophy for posting a 1:17.19. Carl Simms was presented with a check for $50 for fifth place, which he returned to RCACF as a donation toward next year's prize money. Rick Landers finished fourth and received $75; Paul Benezra collected $150 for a third-place finish. Greg Doe received $300 for an exciting second-place final, and Jake Jacobson earned $1,000 for his first-place victory.

"A gracious thank-you goes out to all the RCACF members who donated their entire weekend to run a great race, and to the following sponsors who donated either prizes or cash:

"SEMPRAS, Dave Latsh, Richard Dennett, Carl Simms, Dennis O'Brien, Dave Tyson, Harry West, Diana Knox, Bill Williamson, Jerry Jaeb, Jim Katz, Rick Landers, Paul Benezra, Mike Klutz, Bob Greer.