HERE'S A SPORT aerobatic Electric that looks like a full-scale airplane and performs like a Gas model.

Tigerkitten "E" began to take shape in my mind in late 1988. After about a year of building and flying Electrics, and watching and flying many that others had built, I was growing tired of all the backhanded compliments—you know, "That flies pretty well for an Electric." It was time to do something about it.

After spending several months analyzing existing Electric designs and giving a lot of thought to what I really wanted my new airplane to do, I began by taking a proven design—one with the flight characteristics I wanted—and making it work with electric power. I chose my Bobcat Mk.2 (February 1988 *Model Builder*). Reducing the model's size so that I'd have the option of using the popular 05 motors, I completely reengineered the structure, taking advantage of the near-total lack of vibration inherent in electric power to achieve a significant weight reduction. All this was done without changing the Bobcat's aerodynamic layout.

My goal was to maximize the performance potential of readily available, over-the-counter electric power systems with a state-of-the-art design. Tigerkitten was created expressly for the best of this equipment. To achieve good sport aerobatic performance, I put a lot of time and thought into finding the particular combination of wing area and structure that would offset the weight penalty of the motor batteries currently available. Performance compares favorably to what experienced Gas modelers have come to expect of their airplanes. You won't have to make excuses for this model on the field.

Neither takeoff performance nor durability was compromised; the Tigerkitten "E" operates without restriction off any surface from which you might expect to fly an engine-powered model of similar size. This was achieved by using a somewhat greater wing area, and hence a lower wing loading, than do other popular models intended for 05 power. This airplane exemplifies the dictum, "Build to fly, not to crash!"

While Tigerkitten is more than strong enough to handle reasonable flight or landing loads, it wasn't meant to be used as a sod hammer. The first prototype (with a red-and-yellow color scheme) weighs 56 oz. in its current power system configuration. With a wing area of 450 sq. in., this yields a wing loading of just under 18 oz. per sq. ft.—very good for an aerobatic model of this size. The plane shows no structural deterioration after a year of active flying.

Though my true love is Scale, I entered Tigerkitten in a local AMA Novice Pattern competition for its first contest just to see what would happen. As the only Electric on the field, it tied with a Gas model for first place.

The two Tigerkitten "E" prototypes after an active flying session. The red-and-yellow model is covered with Sig Silray cloth dyed with Rit fabric dye and attached and sealed with clear nitrate dope. The color finish is Stits Polytone, a full-scale aircraft paint. The later version uses dope-finished orange Litespan and Bahama Blue Stits Polytone. With no fuel spills to worry about, the planes look great without any cleanup.

TIGERKITTEN "E"

Put a geared Astro cobalt 15 in this state-of-the-art Electric, add an 11 x 7 prop and either a 12-cell 900-mAh SCR battery pack or 14 SR 1000 Max cells—and go show your gas-power buddies what quiet aerobatics are all about. Don't bother to make excuses for this Electric—you won't need them. ■Robert A. Benjamin

At the 1990 U.S. Scalemasters championships at Dallas, in which I was privileged to fly my ⅛-scale Porterfield as the first modeler to qualify and compete using electric power (see my article "Porterfield Collegiate," April 1991 *Model Aviation*), I was invited to demonstrate the red-and-yellow prototype during the noon break on all three days of flight judging. In winds that never dropped below 20 mph, the little 'Kitten flew a satisfying basic aerobatic routine, surprising the large crowd with its clean, silent flight despite conditions that would have discouraged many from putting their Gas models in the air. If only I could include a videocassette with each copy of this article so that you could see for yourself the difference in Tigerkitten's performance when compared with the typical Electric.

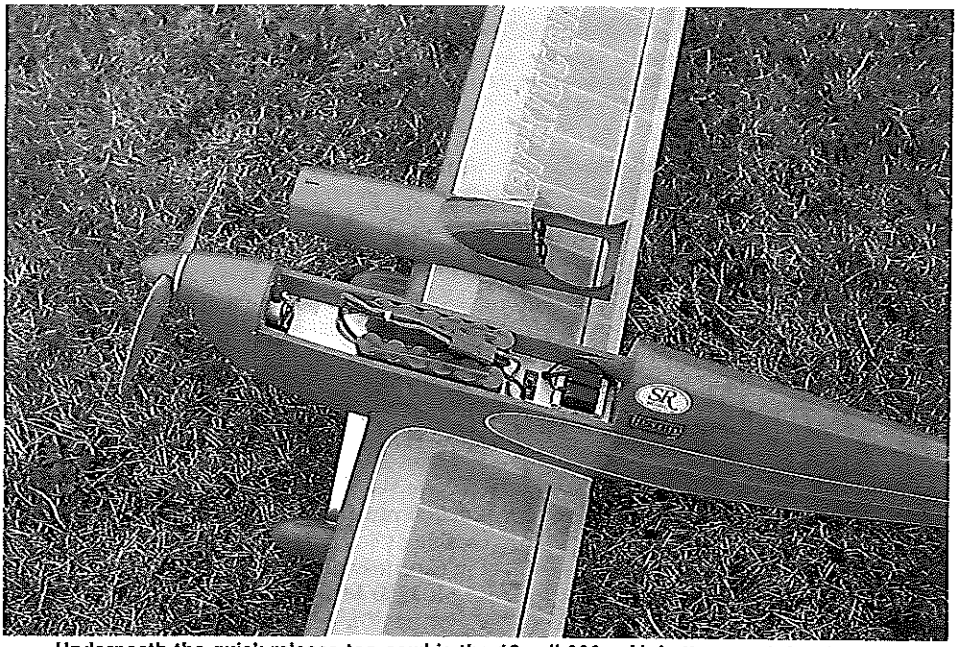
Power systems. One key to Tigerkitten's success is my use of the very best electric power systems available.

I cannot overemphasize that if you're serious about Electric flight and want to enjoy the sort of performance that we expect of gas power, you owe it to yourself to spend the extra money for a cobalt motor system. I'm familiar with the Astro Flight line of cobalt motors and recommend them. Simply put, these motors will handle the high current loads required to fly the way we want to fly, on a prolonged basis and without deterioration. Pay for quality—and enjoy it.

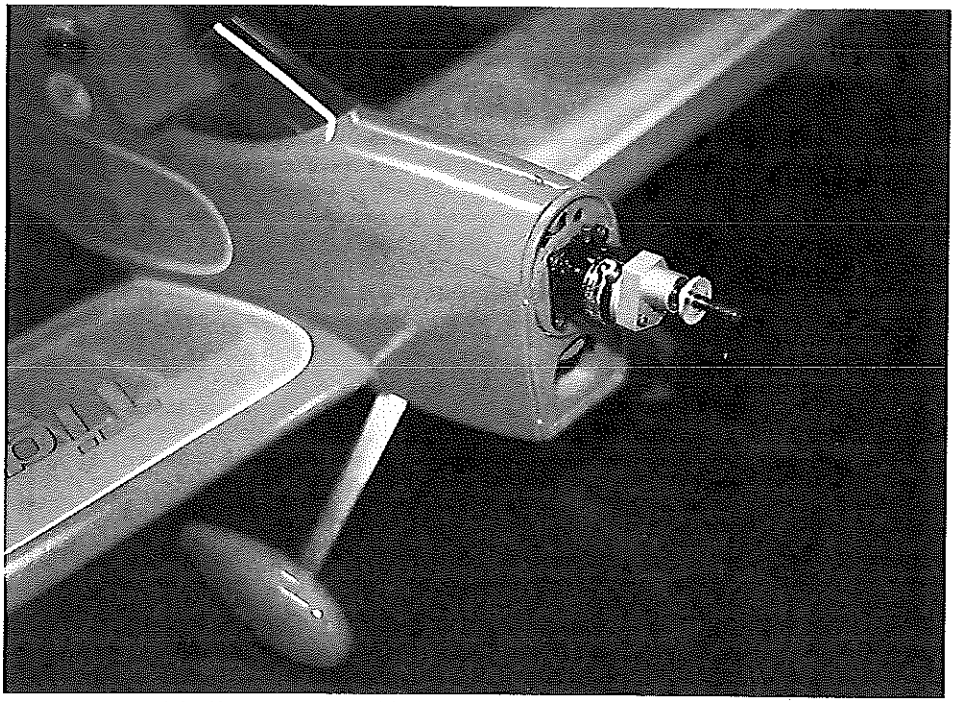
Currently I have two prototypes. Some minor internal refinements were made in the second. These are reflected in the plan. Otherwise the two are structurally identical but feature different color schemes and power systems.

The number one prototype began life as part of an attempt to optimize the performance available from 05-size systems. Initially I used a stock geared Astro cobalt 05, turning a cleaned-up Rev-Up 11 x 7 prop on the nominal battery of seven 1,200-mAh Sanyo SCR cells. Performance was acceptable, but not outstanding.

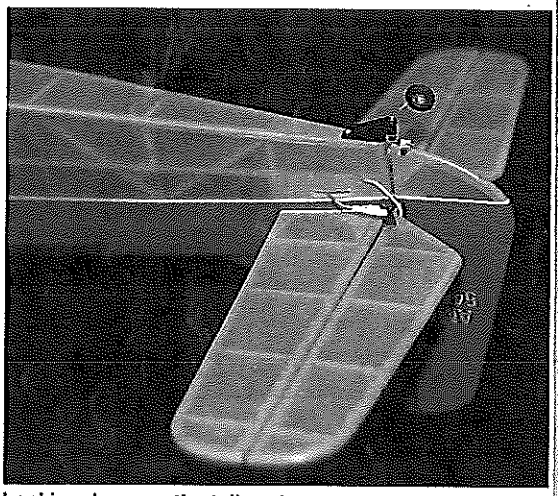
At present I use nine SCR 1,200-mAh cells and a cleaned-up Super M 11 x 8¼ prop. These are no longer on the market, but a cleaned-up Rev-Up 11½ x 8 offers nearly the same performance. I cut way down on power loss and dramatically increased rpm by replacing the stock power connectors with Sermos connectors. Astro Flight, by the way, is expected shortly to introduce its own low-loss



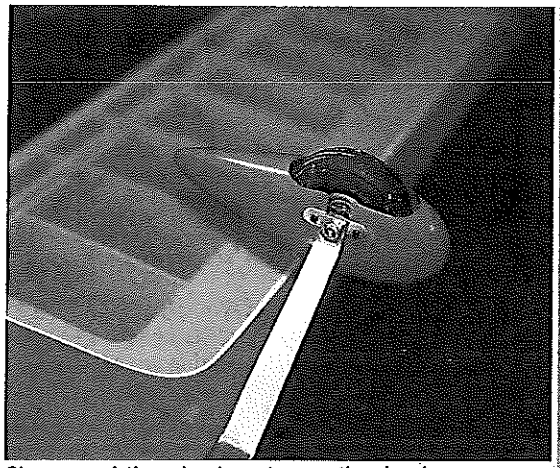
Underneath the quick-release top cowl is the 12-cell 900-mAh battery pack for the Astro cobalt 15 motor. The author currently is experimenting with 16 SR 1250 Magnum cells.



The nose of the No. 2 prototype with the cowl removed. Stepping up from the Astro cobalt 05 motor he used in the first prototype to the geared Astro cobalt 15 in this one, the author was rewarded with slightly better performance. Mounting dimensions for the 05 and 15 motors are identical, so it's difficult to tell the two installations apart without close examination.

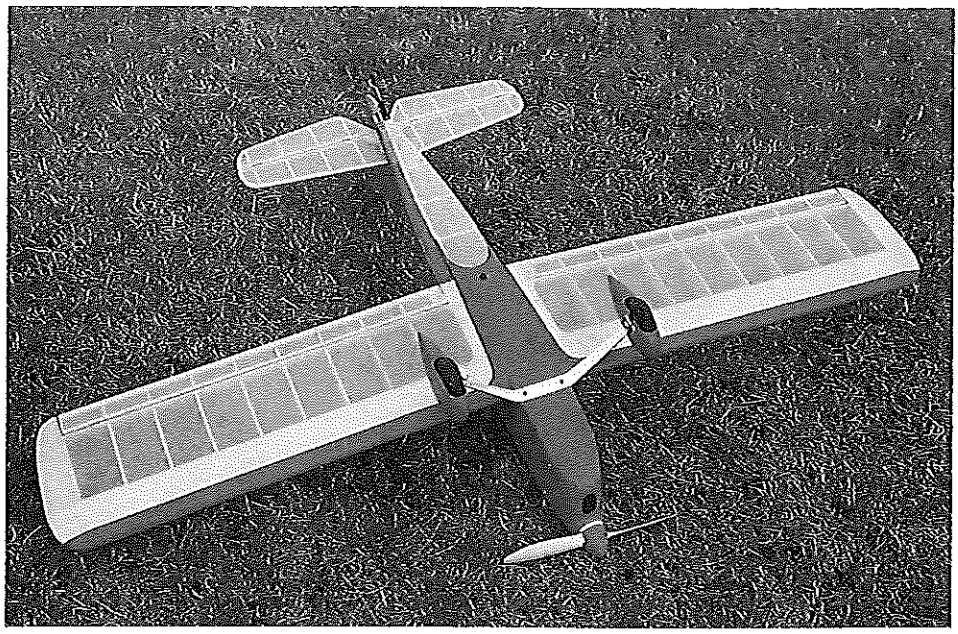


Looking down on the tail surfaces of the No. 2 model. Note the elevator horn and pushrod connection, the tail wheel assembly, and the exit routing of the receiver antenna.



Close-up of the wheel pant mounting hardware in the second prototype.

Left: At left is the back panel of the cockpit with the locking pins for the removable top cowl/cockpit assembly. The white circles are used to simulate the instrument panel. At right is the front panel of the turtledeck. Note the small insertion tubes for the cowl locking pins. Right: A look into the cockpit opening/cooling air outlet shows the rear of the rudder and elevator servos, the arming switch and Astro cobalt 15 system charging plug, and, hidden under the instrument panel, the radio switch.



No, it isn't a bad landing, just a belly view of the No. 1 prototype.

connector that will be competitive with the Sermos variety and perhaps less tricky to use.

Throttle control is via a Jomar SM-4, an optically coupled, high-efficiency, high-rate throttle.

This combination of equipment allows effortless takeoffs from the somewhat rough and usually wet grass off which I normally fly; clean, sequential loops from level fight; good Cuban eights; point rolls; and even inside square loops. With proper use of the throttle to retard power to cruise level between maneuvers, the motor, throttle, and battery are only moderately warm on landing.

Duration is about five minutes-plus if I fly a lot of aerobatics, six or seven minutes if I'm just cruising around. This is a considered trade-off—using less voltage (fewer cells) and accepting less challenging performance would increase duration. Here's an area in which ongoing improvements in cell technology will make Electric flight even better in the future.

After developing the first prototype to this level, I realized that I had pushed the Astro 05 well beyond commonly perceived limits—although not nearly as far as it's capable of going. Moving up to a geared Astro cobalt 15 in the second, blue-and-orange version seemed to make a lot of sense. On a stock geared cobalt 15, the nominal battery of 12 900-mAh SCR cells and an APC 11 x 7 prop, the second prototype slightly outperforms the first.

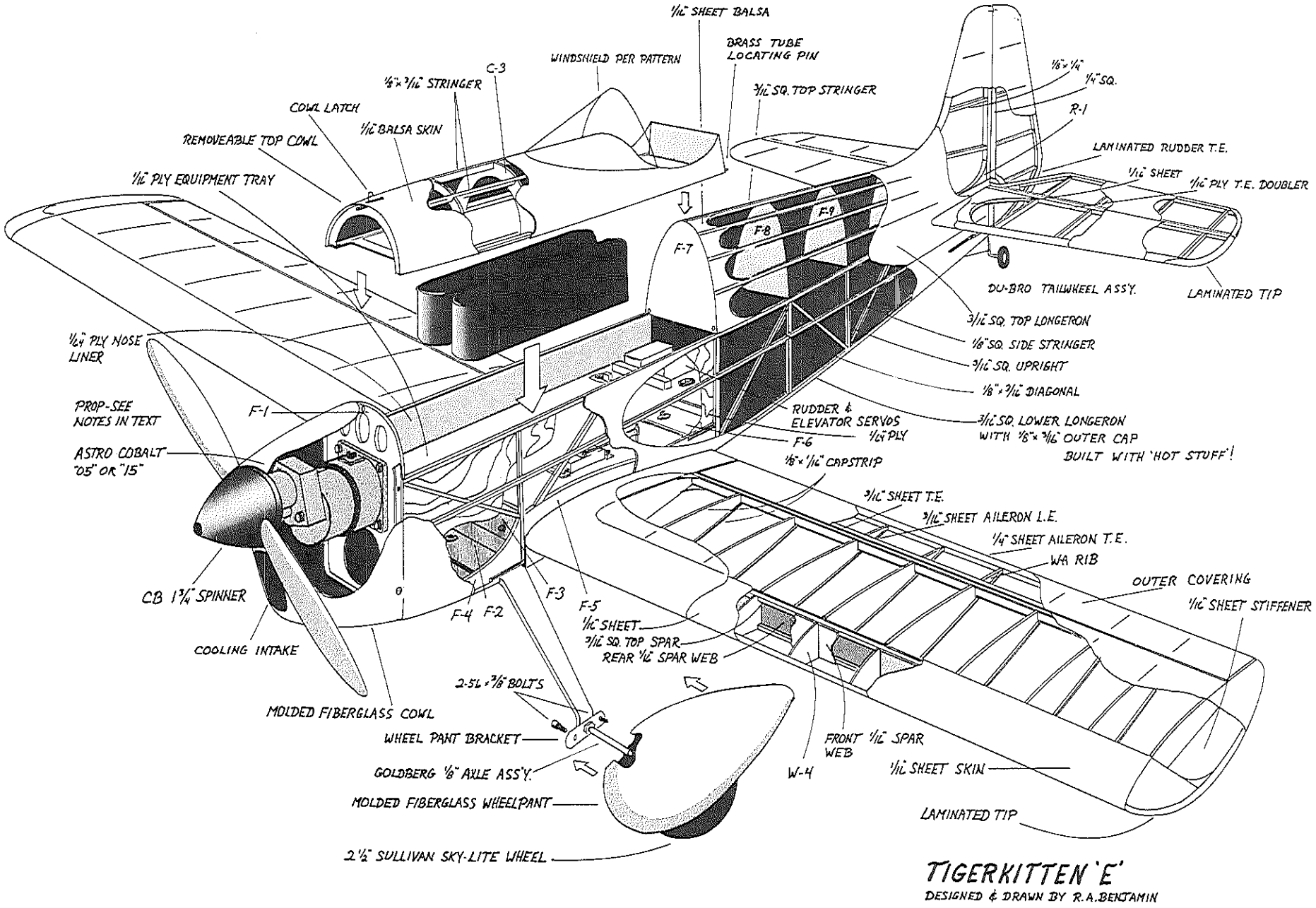
I'm currently flying model number two with the same cobalt 15 running on a pack of 14 SR 1000 Max cells, with the new Astro Model 205 throttle for control. This throttle is well worth your attention. Although more expensive than the Jomar SM-4, it will handle more power and is supplied fully self-contained and ready to mount, making it vastly easier to set up and install. This power combination turns the APC 11 x 7 prop at 7,200 rpm and flies the airplane with distinct authority.

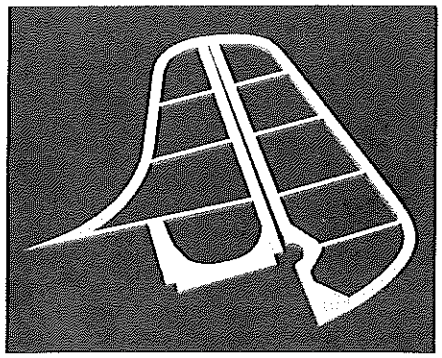
I have refrained from using higher pitched props on airplane number two because the 11 x 7 is pushing the cobalt 15 to its recommended sustained current level of 15 amps; this motor is designed to create additional power through the application of higher voltage. In contrast, the 05 used on the first prototype is designed to permit higher current draw—hence my use of higher pitched props, which have raised static current to nearly 30 amps.

I have yet to reach the limits to which either airplane-equipment combination is capable of being pushed. At this writing I'm experimenting with a battery pack of 16 SR 1250 Magnum cells in the second prototype. Thus equipped, the airplane weighs 62 oz. (with a wing loading of 20 oz. per sq. ft.), just as it does with the nominal 12-cell 900-mAh SCR pack. There are limitations on the sustained current draw that the SR 1250 Magnums can tolerate, so it appears at this point that the Astro cobalt 15 might be an ideal motor with which to use them. Performance promises to be spectacular, but I'll have to leave you in suspense. As I write, it's November in western Washington State, and it won't stop raining.

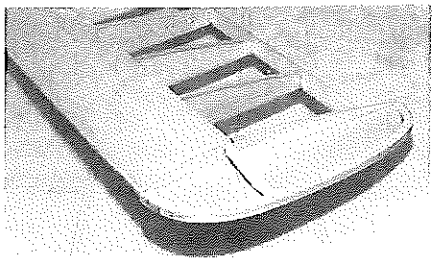
Let me emphasize that my self-described pushing of the power systems in no way abuses the Astro cobalt motors. With a proper understanding of the current and voltage loads for which these motors are designed, judicious propeller selection, and proper understanding of air cooling of equipment and use of the throttle, rather extreme performance is routinely available.

The radio equipment in both airplanes is based on two of my Airtronics Championship 7 FM transmitters, updated with model 92765 dual-conversion 1991 receivers. The Airtronics 94401 servos are very lightweight. All my radio batteries are from SR Batteries. This company's 300-mAh airborne receiver packs are not only lightweight and reliable, but allow you to use fast field charging without

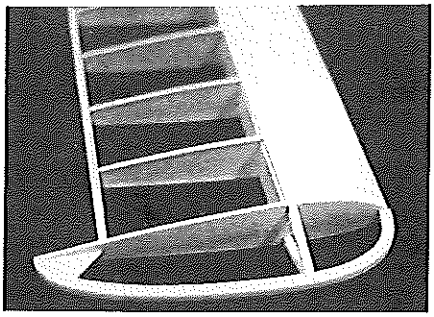

1/16" SHEET BALSA
BRASS TUBE LOCATING PIN
WINDSHIELD PER PATTERN
C-3
1/8" x 3/16" STRINGER
3/16" SQ. TOP STRINGER
COWL LATCH
1/16" BALSA SKIN
REMOVEABLE TOP COWL
1/16" PLY EQUIPMENT TRAY
1/8" x 1/4"
1/4" SQ.
R-1
LAMINATED RUDDER T.E.
1/16" SHEET
1/16" PLY T.E. DOUBLER
F-9
F-8
F-7
DU-BRO TAILWHEEL ASS'Y.
LAMINATED TIP
3/16" SQ. TOP LONGERON
1/8" SQ. SIDE STRINGER
3/16" SQ. UPRIGHT
1/8" x 3/16" DIAGONAL
1/4" PLY NOSE LINER
PROP-SEE NOTES IN TEXT
F-1
RUDDER & ELEVATOR SERVOS
1/16" PLY
F-6
3/16" SQ. LOWER LONGERON WITH 1/8" x 3/16" OUTER CAP
BUILT WITH 'HOT STUFF'!
ASTRO COBALT "05" OR "15"
1/8" x 1/16" CAPSTRIP
3/16" SHEET T.E.
3/16" SHEET AILERON L.E.
1/4" SHEET AILERON T.E.
WA RIB
OUTER COVERING
1/16" SHEET STIFFENER
CB 1 3/4" SPINNER
F-4
F-2
F-3
F-5
1/16" SHEET
3/16 SQ. TOP SPAR
REAR 1/16" SPAR WEB
COOLING INTAKE
2-56 x 3/8" BOLTS
MOLDED FIBERGLASS COWL
WHEEL PANT BRACKET
GOLDBERG 1/8" AXLE ASS'Y.
MOLDED FIBERGLASS WHEELPANT
FRONT 1/16" SPAR WEB
W-4
1/16" SHEET SKIN
LAMINATED TIP
2 1/2" SULLIVAN SKY-LITE WHEEL
TIGERKITTEN 'E'
DESIGNED & DRAWN BY R.A.BENJAMIN



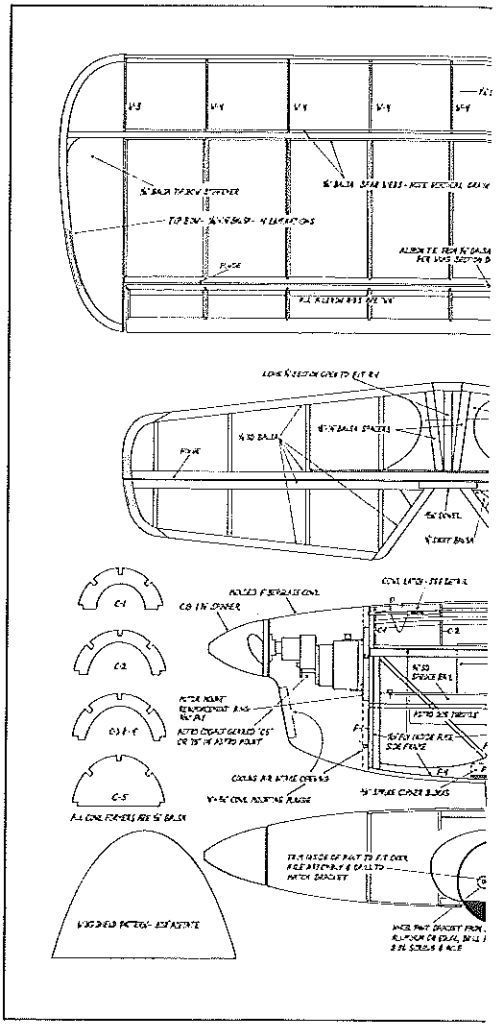
The vertical tail and rudder completely assembled. Construction begins with the horizontal and vertical tail surfaces.



The laminated wing tip has been completely assembled except for the addition of the short spar leading edge extension on top. Note that the lamination form is still in place.



The wing is structurally complete except for the installation of the aileron.



compromising the batteries.

After comparative testing of both airplanes, I recommend that, if you're not already committed to particular equipment, you consider starting off with the geared Astro cobalt 15 and the 12-cell battery pack. Should you have a geared 05, you can expect about the same performance on a nine-cell battery, although gross weight will be about five ounces lower and duration several minutes less.

The 12-cell/cobalt-15 combination gives me honest seven- to eight-minute flights. While I suppose that any number of the higher performance ferrite motors would fly the design safely, I remain unconvinced that they'd fly it as well.

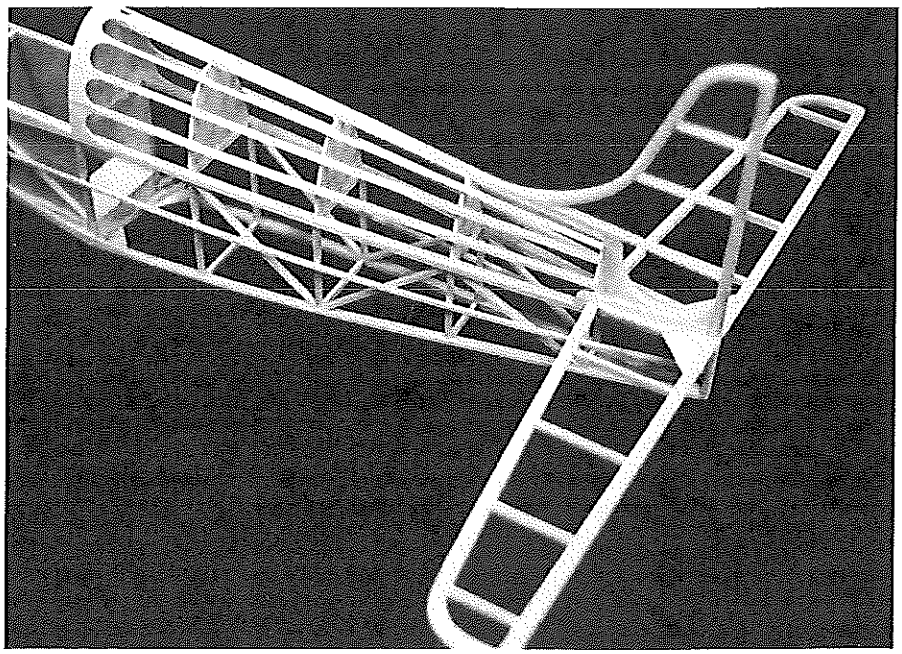
If you're an accomplished flier who wants to try Electric, you won't have to step down from the performance level to which you're accustomed with Tigerkitten "E." It's a great way to get started. I must take exception to the notion that an experienced flier ought to start out in Electric with an inexpensive, low-powered model. Such an airplane may simply confirm his suspicions about Electrics' lack of performance. What could be more discouraging?

Let me also emphasize that Tigerkitten is not a trainer. Many good trainers, both Gas and Electric, are available for those of you who are learning to fly. By the way, to match the power and performance of a primary Gas trainer, simply equip a ready-made Electric trainer with one of the recommended Astro cobalt power systems. Think about that.

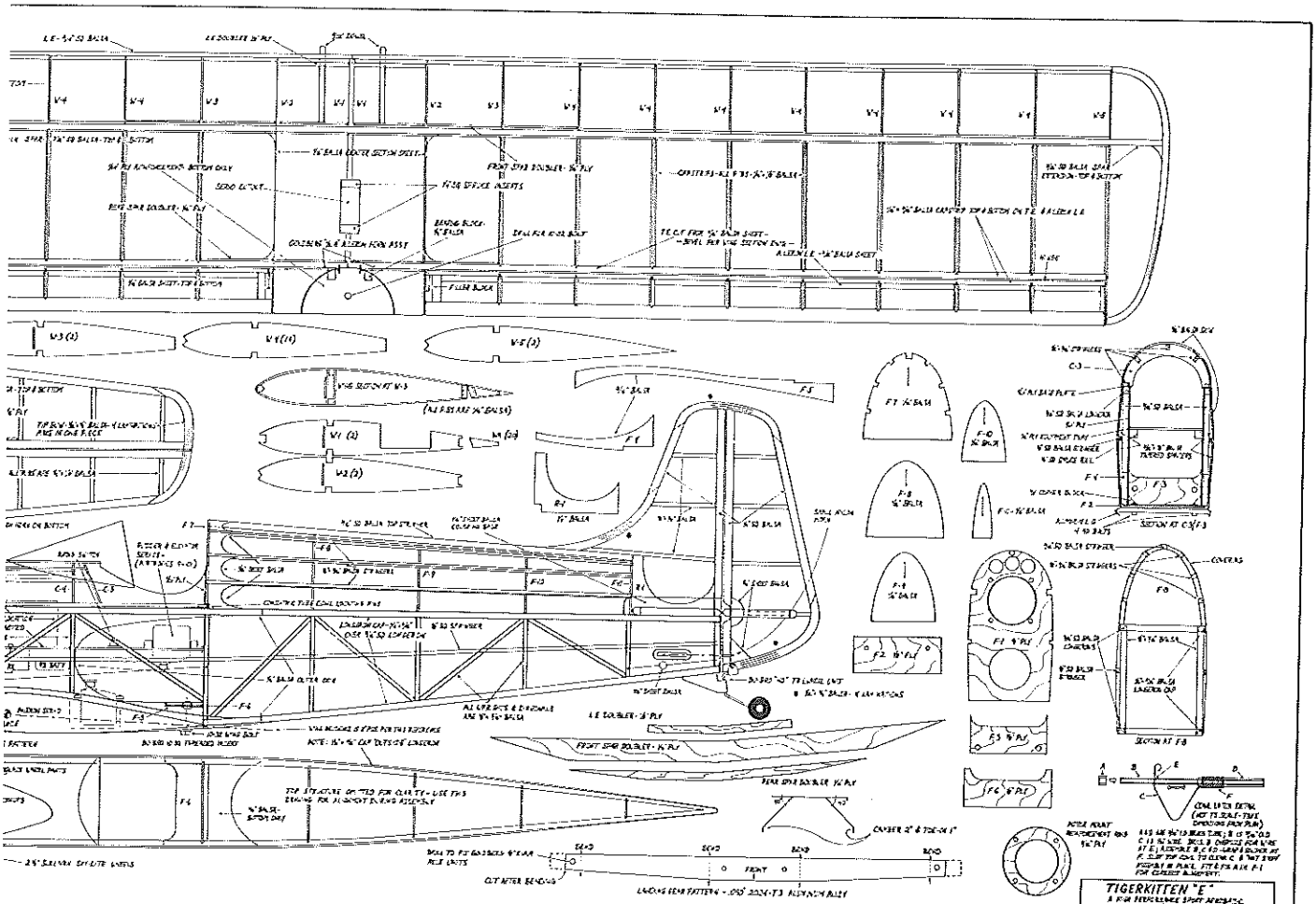
Aircraft structure for Electric flight. Given the current state of development of electric power systems, the key to equaling gas-powered performance is to compensate for the weight of the motor battery with a proportionately light structure. Several characteristics of electric power make this practical and prevent the airplanes from becoming fragile.

Because electric power is very nearly vibration-free and produces *no* fuel or exhaust residue, much of the structure that's essential in Gas models becomes redundant in Electric. To absorb and damp the vibration inherent in even the smoothest running, best balanced two- and four-stroke engines, we must include a lot of plywood, thick balsa, and extra glue that contribute nothing to airframe strength in terms of resisting flight loads. The quarter-inch sheet balsa sides of so many .40-size sport models are a good example; were it not for the vibration, I submit that appropriately braced $\frac{1}{8}$-in. or even $\frac{3}{32}$ sheet would do the job perfectly well. Clearly, that would eliminate the need for a heavy bath of epoxy inside the nose, just as do the most sensibly constructed Electrics.

The problem is that we've become so accustomed to building to resist vibration that structure designed in any other way tends to look suspect. Closely allied is the trend toward using the largest engine that will stay attached to the airframe at full power. Little wonder that many of these Gas models have wing loadings reminiscent of a fat brick, though they'll



The fuselage sides have been joined with balsa crosspieces and at the tail post, the formers and stringers added, and everything rounded by sanding and faired into the rudder. The horizontal tail surfaces are also in place.



Full-Size Plans Available . . . See Page 188 **Detailed construction notes accompany the full-size plans.**

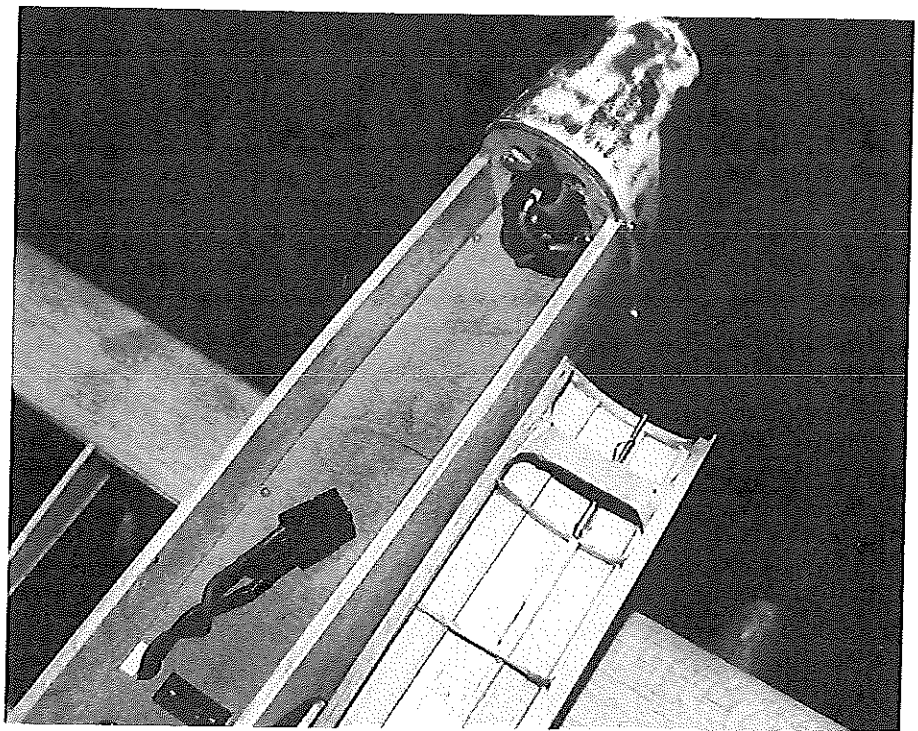
climb straight up easily enough. We're so accustomed to seeing this sort of thing that a perfectly airworthy structure designed to withstand normal flight loads and reasonable handling all too often strikes us as flimsy. If you've built any Free Flight models, you already understand this.

To keep Tigerkitten as light as intended, it's important to use materials of appropriate dimensions. Several other considerations must be kept in mind.

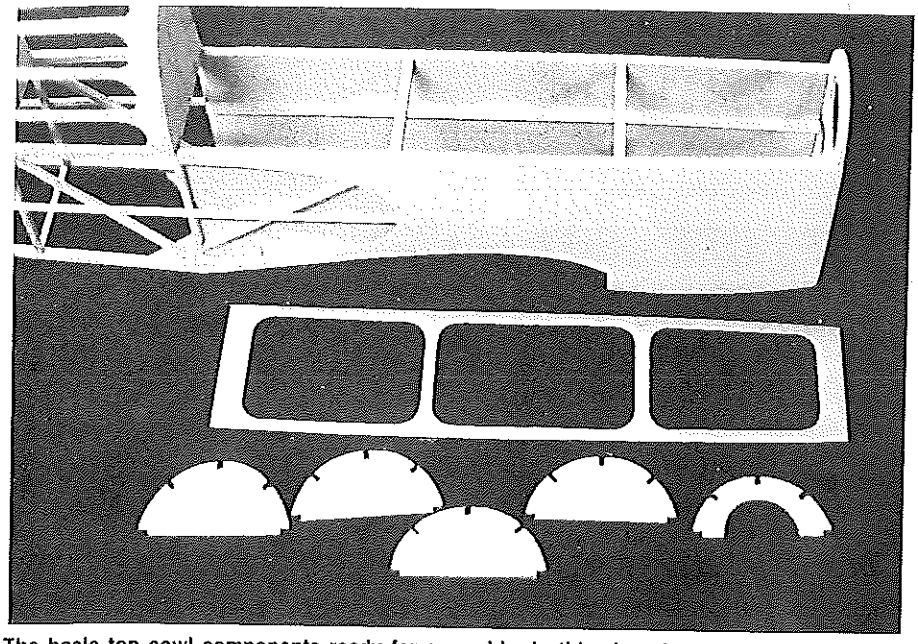
Wood selection is critical. This is the place for contest-grade balsa, available at better hobby shops. Though it's somewhat more expensive than the garden-variety stuff, it makes all the difference. Good-quality balsa of four- to six-pound density can save you six ounces on total weight.

Your choice of adhesive is equally critical. This isn't the time for lots of heavy epoxy. I use Hot Stuff products exclusively. Both Tigerkittens were built with the thick variety of UFO cyanoacrylate (CyA) glue and an occasional shot of the fast-setting, thin variety. Independent tests have shown Hot Stuff to be by far the strongest of the CyAs on the hobby market, and I have observed that the UFO formulation can eliminate problems of irritation for sensitive individuals. If you're uncomfortable using this type of material or do indeed have an allergy problem, try an aliphatic resin instead.

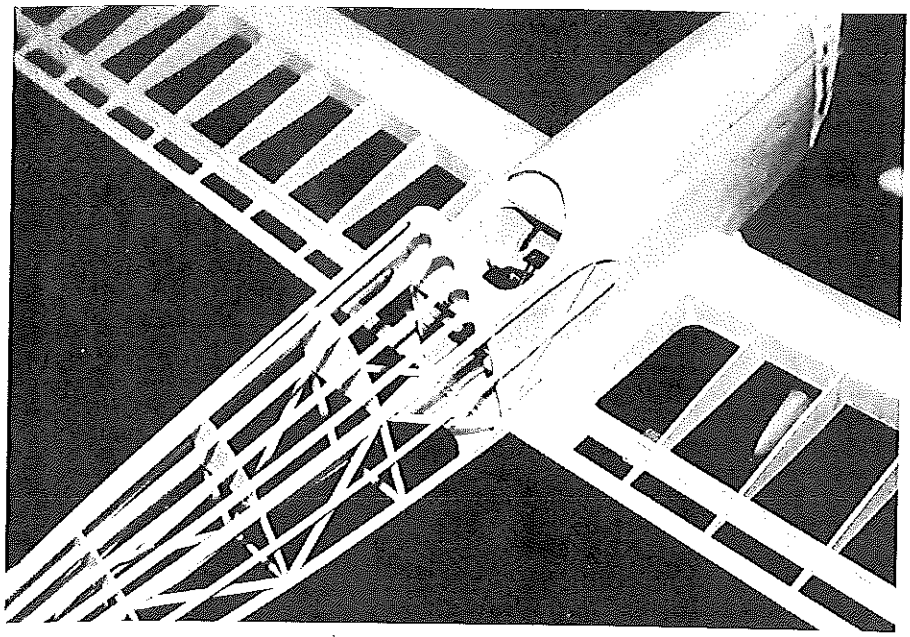
Any adhesive intended for wood does its work in the area between the parts being joined. Excessive glue "squeezeout" is a



The removable top cowl permits battery replacement in seconds. Fiberglassing the cowl adds immensely to strength and durability. The No. 1 model has been flown for a year with absolutely no problems related to the cowl or the surrounding fuselage structure.

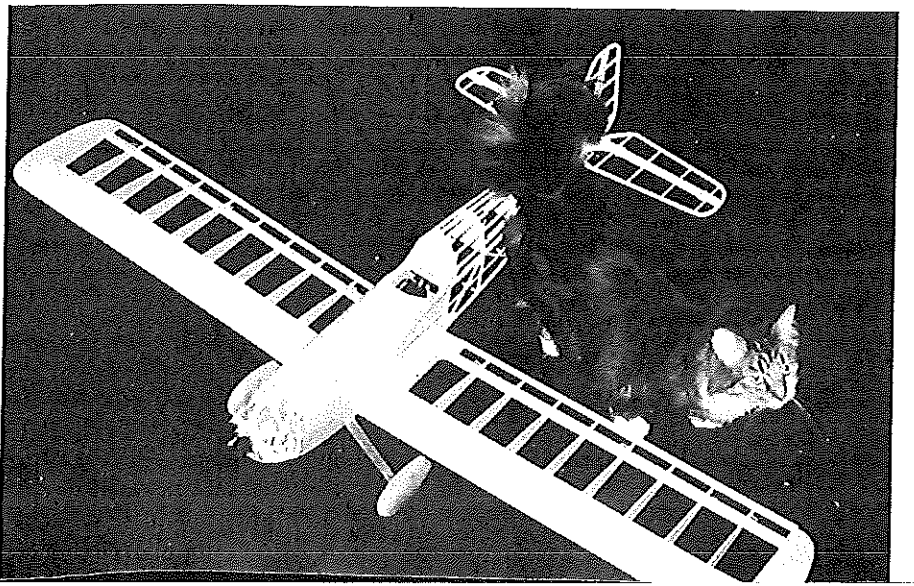


The basic top cowl components ready for assembly. In this view the base plate has been opened up sufficiently to accept the 05 battery packs for the No. 1 prototype.



The airframe is structurally complete and ready for covering.

Since the Tigerkitten's structure relies to some degree on the tension of the covering for torsional rigidity, use one of the heavier film coverings or old-fashioned fabric-and-dope. Bet that kitten brings good luck to its namesake. All photos by Robert A. Benjamin.



sign of sloppy work and adds excess weight. The would-be craftsman who recommends a layer of glue wiped outside the joint betrays his ignorance of the principles of wood aircraft construction. Wet the area to be joined thoroughly but lightly with glue, use light clamping pressure while joining parts, and you'll do the job right. Make it fit, sand it some more, and "build smarter."

While we are on the subject of weight, I'll give you some targets to aim for. The completed wing, fiberglassed and with hinges in place but without servo or covering/finish, should weigh between five and seven ounces. The completely finished wing of airplane number two weighs 8.5 oz. flight ready. The bare fuselage/tail assembly without motor, battery, landing gear, or radio should weigh between six and eight ounces. If you can hit these weights, use an appropriate covering/finish, and install the recommended or equivalent power and radio equipment, you'll have no problems related to weight.

Covering and finishing. Several options are available. Doubtless most of you will choose from among the one-step plastic film coverings. My only comment on these is to suggest that you accept a slight weight penalty for the sake of the somewhat greater structural rigidity that the heavier films offer. The model's structure is intended to rely to some degree on the tension of the covering for torsional rigidity, and the lightest of the films won't help as much.

I personally prefer a more traditional approach to covering and finishing, both for the opportunity to exercise craftsmanship and because of the greater strength and durability that a properly executed fabric-and-dope finish provides. This type of covering can be shrunk tighter than plastic film, and the painted finish permanently seals and locks all seams.

Airplane number one is covered with Sig Silray cloth dyed with Rit fabric dye. It is attached and sealed with clear nitrate dope. The color finish is Stits Polytone, a full-scale aircraft paint that is part of the Stits Process aircraft covering and finishing system.

The Stits Polytone is the best stuff I've ever seen for finishing airplanes of any size. A light, one-part paint with excellent covering power, it's easy to spray, forgiving of overspray and repair, fuelproof (if your glow-power friend slops fuel on your airplane), and totally nonshrinking. Think about that last one!

If you wish to write for the Stits information brochure, or for a manual describing the company's entire product line for full-scale use, both are available from the address given at the end of this article.

I should mention that the Polytone paint to which I referred is intended for use over

Continued on page 134

high-current terminal voltage of seven volts (7,000 millivolts) total, 5.7 millivolts (average) would represent only 0.08% loss.

As an example, at 10,000 rpm nominal, the loss associated with one two-pin connector set would be about 16 rpm, and this would not be visible on a three-digit tack. The percentage rpm loss would, of course, be even smaller with higher cell counts.

Incidentally, all this info is for new connectors. Since I have no accumulated history of application, I can't say how the connector performance will hold up in repeated mating. However, I have no reason to expect any significant deterioration in normal modeling use—including use with the charging function, the most often exercised electrical joint for those without a separate charge jack.

I'd like to close this month with a short story about power. I'm always impressed with the seemingly awesome power that one can associate with an Astro 60 or with some of the impressive-sounding big imported motors. For example, a 60 on a 28-cell pack with a peak current condition of, say, 30 amps is over one horsepower—840 watts assuming one volt per cell. Certainly, a kilowatt is in-bounds.

Awesome, huh? Well, just to put things in perspective, I recently enjoyed a social conversation with a third-year physics graduate student. He was telling me of the project he is working on. In particular, he is developing a power supply for a particle accelerator. This power supply develops one megavolt and supplies one megampere for 60 nanoseconds. That is to say that this supply develops 1,000,000 volts and delivers 1,000,000 amps (or one terawatt) for 0.000000060 seconds. The voltage rise time is 20 nanoseconds, giving a slew rate of about 50 mega-megavolts per second.

Next time you're wallowing in the thoughts of the awesome power of your biggest Electric, reflect on the above! It kinda puts us all in place, wouldn't ya say.

Incidentally, can anyone guess what this project uses for a switch? And wire?

Finally, in case you're wondering, Electric Installations will continue in the future. And with that, another column closes. Please have a happy and safe Electric flying season! See ya at the Greatest (Electric) Show on Earth—KRC! □

RC Tiger/Benjamin

Continued from page 32

Stits covering and base finish products. I have determined that for our purposes, it works very well over clear nitrate dope. I did use the Stits Process line exactly as indicated for full-scale aircraft on my Scalemasters Porterfield, with excellent results.

Tigerkitten number two is covered with a new product called Litespan. A heat-shrink plastic made in England, Litespan i imported and distributed by Idealair Models and Charlie's R/C Goodies. It's available in a number of transparent and opaque colors and weighs only 1/10 oz. per sq. ft.—lighter than any comparable material on the market. Like Micafilm, it' applied using an iron and a separate, brushed-on adhesive. But unlike Micafilm Litespan is paintable—really! I tested quite a few samples before deciding to use the stuff on my Tigerkitten.

The blue-and-orange airplane is covered with transparent orange Litespan and finished with two coats of clear nitrate dope (which shrinks it even tighter than heating), Bahama Blue Stits Polytone, white striping tape, and two coats of clear Polytone. An Electric covered with Litespan but without the added paint finish would probably hold up well. But the advantages of the paint finish in making the covering significantly tauter and addin gloss and durability are more than worth the several ounces of added weight. The custom Tigerkitten "E" markings on both airplanes were made to order by Vinylwrite Custom Lettering.

Preparing for flight. With your chosen covering and finish in place, put everything back together and be certain it all works the way you want it to. Set your control throws to give an aileron differential of about two to one.

This can be done either by bending the aileron control horns forward or by attaching the pushrods to the servo output aft of center. Or use a combination of both. The purpose is to eliminate the need

for coordinating rudder with aileron to prevent adverse yaw in turns. Start with about 20° *up* and 10° *down*. Elevator movement should be 20° each way, and rudder at least 35°. Once you're comfortable with the model, you may want to increase these movements somewhat.

Install the battery pack, and move it around until the airplane balances at the point shown on the plan—25% of chord. At this balance point, the airplane is properly responsive to all controls without becoming jumpy. Spin entry and level snap rolls are positive if sufficient elevator throw is used, and recovery is virtually instantaneous. I've dragged both airplanes nose-high at low speed all over the sky without having to do anything more violent than mush down when the speed got too low.

I suggest that you test your Tigerkitten "E" with this balance point. If you then decide you want snappier stall maneuvers, move the center-of-gravity back to between 30% and 33%.

I cannot overstress the importance of doing a thorough job of preflight testing of the entire airplane and all its systems. Range-check with and without the motor running. Use an ESV (expanded scale voltmeter) on your receiver and transmitter batteries at the beginning of every flying session. Make absolutely certain that the model is balanced, aligned, and warp-free before that first flight, and you'll be set for years of rewarding flying.

Flying. Remember to start sharp and anticipate your actions. Let the airplane build up speed, and fly it off the ground fast and flat until you're sure of what it's going to do. Trimmed as indicated, the Tigerkitten "E" will go essentially where you point it, with a touch of positive stability in all axes. Don't be afraid to blink, but pay attention and stay oriented to the airplane. My Tigerkittens seem to prefer being brought down, a little on the fast side, in wheel landing attitude (mains first, tail wheel in the air), rather than being three-pointed.

Once you're at ease with the airplane, I urge you to experiment with prop/battery combinations. I am most anxious to receive input from all who build and fly this design, in order to establish a wider base of information on power options than I could ever do alone. There may well be a 40-size version in the future, and many of the fine points of that design could depend on your shared experience with the 05-15 version.

Good luck, and *think Electric*!

Additional information on Stits products is available through Bob's Aircraft Supply & Avionics, Attention: Karen Sandberg, Pierce County Airport, 17017 Meridian E., Puyallup, WA 98373; telephone 800-331-4375, or 206-848-9349 from Canada. Karen Sandberg has agreed to make Stits products available direct or via mail order in the quantities that modelers use. Contact her about purchasing a copy of the very complete Stits manual at $15.

Bill of Materials

Balsa (All sheet stock is contest grade. All strip stock is light but firm.):

11 1/16 x 3 x 36 in.
Two 3/16 x 2 x 36 in.
One 1/8 x 2 x 36 in.
One 1/4 x 2 x 36 in.
10 3/16-sq. x 36 in.
Four 1/4-in. sq. x 36 in.

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Eight 1/8 x 1/16 x 36 in.
12 1/8 x 3/16 x 36 in.
Eight 1/16 x 3/16 x 36 in.
Two 1/4 x 1/8 x 36 in.
Two 1/8-in. sq. x 36 in.
Eight 1/16 x 1/4 x 36 in.

Spruce:

Two 1/4-in. sq. x 36 in.

Aircraft plywood:

One 1/8 x 6 x 12 in.
One 1/16 x 12 x 18 in.
One 1/64 x 6 x 18 in.

Hardware:

One pair 2½-in. Sullivan Skylite wheels
Four 1/8-in.-dia. wheel collars
One pair Goldberg 1/8-in.-dia. axle assemblies
One set Goldberg ½A strip aileron horn assemblies
Two small nylon control horns
Six 2-56 nylon clevis/rod sets
24-plus servo-mounting sheet metal screws
Six 3/4 in. x 4-40 allen-head bolts and blind nuts
Four 3/8 in. x 2-56 allen-head bolts and locknuts
One Du-Bro 10-32 nylon wing screw
One Du-Bro 10-32 brass threaded insert
Two small nylon pushrod exit guides
15 small nylon pin-type hinges
One Du-Bro No. 40 tail wheel mount assembly
One 3/4-in. tail wheel
One 2024-T3 x .090-in. aluminum alloy or appropriate commercial landing gear
One CB Associates 1¾-in. backplate-type plastic spinner
One Astro cobalt 05 or 15 motor system
Throttle and radio system of choice
One yard 3/4-oz. fiberglass cloth
Covering, finish, and adhesive of choice

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RC Helicopters/Jolly

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gimbaled Sony color video cam with down-link T.V. transmitter. The unit is super and could have some definite industrial or rescue applications. Those of you who are interested in this project can contact Juan at 415/930-0475. I have also been playing with a video-equipped RC aircraft and helicopters. It is quite a challenge to get everything working right. But when it comes together, oh what a picture you have.

I understand that there was some great night flying on Saturday night. I'm sorry I missed it.

I was in attendance to witness the Orange County Radio Control Helicopter Association crash crew, Kirk Olsen, Herb Hoskins and Joe Busher putting their X-Cell 60 back together. Evidently the switch harness failed during flight Saturday afternoon. The X-Cell then proceeded to fly for about two minutes—apparently mimicking a Curtis Youngblood demonstration which included inverted flight and pirouettes—all without benefit of help from a transmitter. The unleashed machine then climbed high into the sky and power-dived into the ground. Anyway, there is a happy ending. Leonard from Nitro Alley opened his shop to the crash crew and they were able to get the parts they needed.

Larry Lloyd, Airtronics master radio tech and local chopper maniac gave the crew a Quick Silver fuselage. The crew patiently watched everyone else fly while they had to work on Sunday morning. By late afternoon, the renovated X-Cell took to the air and flew as well as before the mishap. As a side note, here, the OCRCHA crash crew would like to thank Raves RC Products for their new molded X-Cell tail fins. The crash crew has completed rigorous field testing and finds that the tail fins are absolutely unbreakable through *abnormal* usage.

I also ran into Gene Engelgau, up in Bakersfield. Gene was spending time with Larry Lloyd, who was field testing