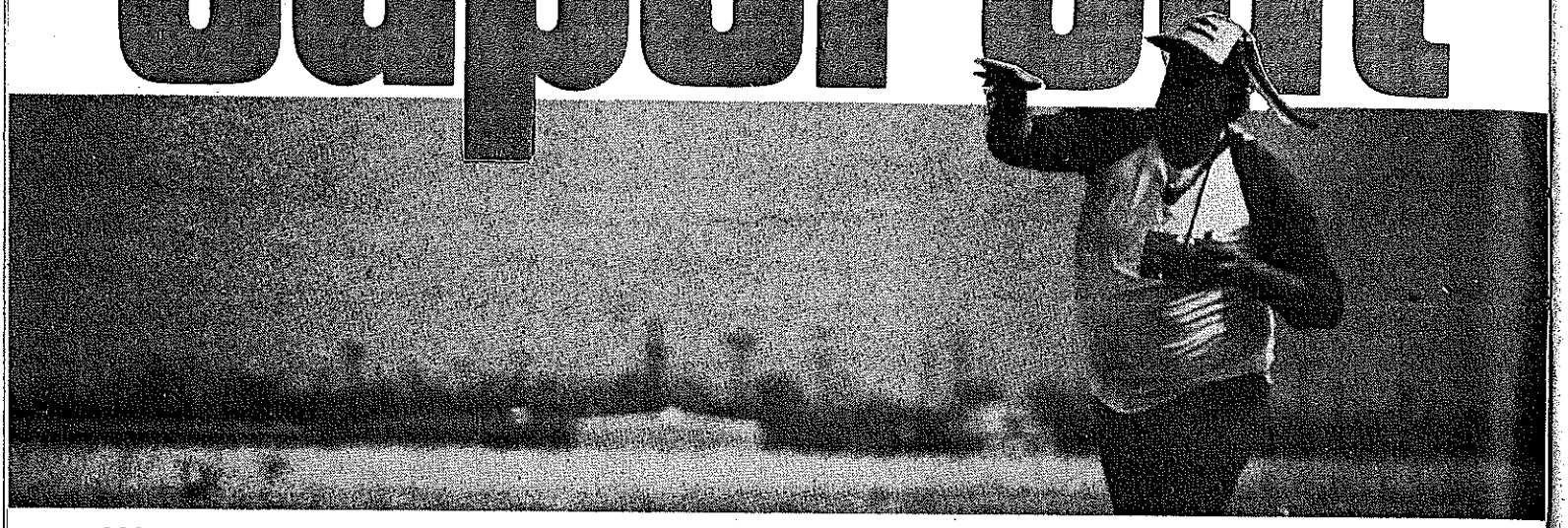
supercat



Warning: This tiny ½A RC model can be habit-forming. It can be built for under $20, uses a $25 engine, and takes about 2 oz. of fuel for 10-minute flights. It needs only two servos and can be flown almost anywhere. It is a tremendous lot of fun. Try it! ■ **John F. Kilsdonk**

HAVING TOILED for many years in the Control Line events and being chronically infested with the competition end of things, it was only natural when I went into RC that I was interested in competition flying. Like most "beginners" I was very eager to learn, but unlike most newcomers I was also quite aware that it would be difficult, and there would be many failures along the way. I had resigned myself to the acceptance of failure as part of the learning process. My basic philosophy was (and still is) that experience is the process of elimination of things that won't work. You try to learn from your bad experiences.

In the late summer of 1976, I had decided to hang up the Control Line models and embark into RC as soon as the current racing season was over. So, for a couple of months, I hung around the local RC field—watching and trying to learn from other people's failures. I observed the better fliers, watched what equipment they had, and tried to learn the mechanics of their procedures.

I made some new friendships and listened to tons of free advice, trying to sort out the "good" advice. With my goal of participating in the RC racing events the following spring, the only commonality in all the advice was to get into a low-winged aileron model as soon as possible.

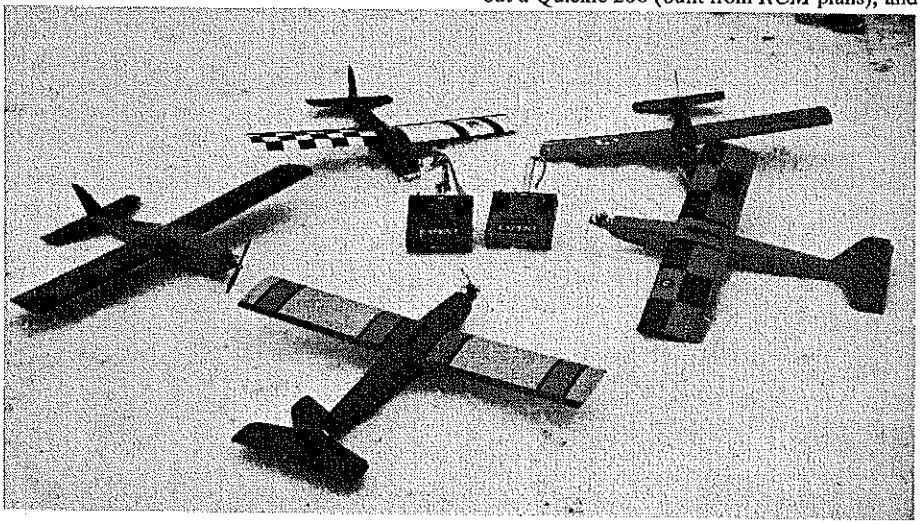
My instructor, Barney Polzin, let me fly a rudder-elevator model a few times, and quite frankly it turned me off. Sensing this, he brought out a Quickie 200 (built from *RCM* plans), and told me he was going to show me how a good airplane flew. I was immediately impressed by the axial rolls and inverted flight which he performed with the model, as most beginners usually are.

The next flight he handed me the transmitter about half way through the flight. The minute I touched it I knew something was different. I stroked it around a little bit, did a loop and a roll, then I got behind it and promptly augered it into the ground. In that brief 30 seconds or so of flying (and in spite of the eventual crash) I was convinced that aileron models were much different and very exciting.

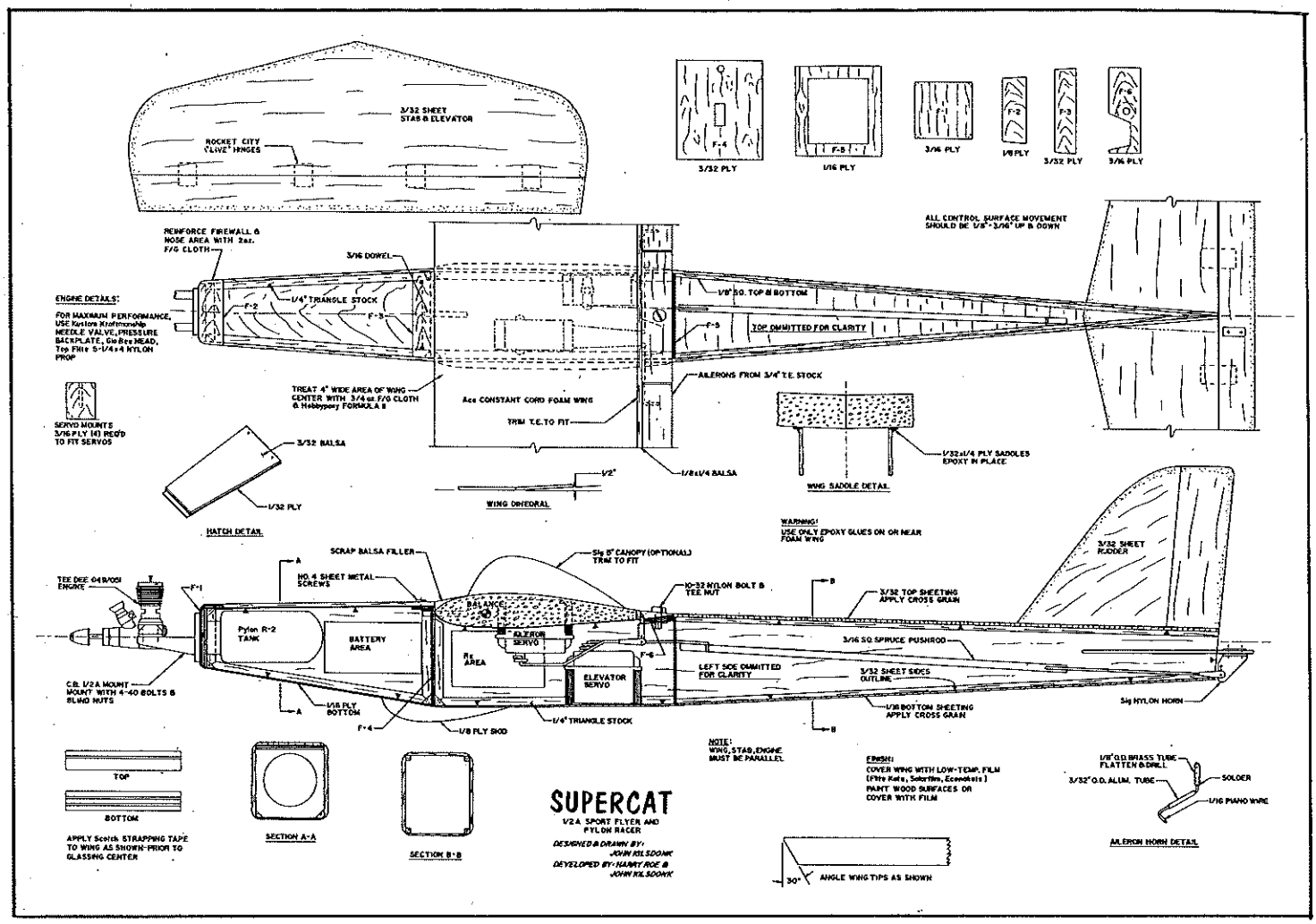
Being my usual bullheaded self, I went home intent on mastering one of those darn aileron models. I subsequently built two Quickie 200s of my own and flew them all winter. Each flying session lasted until the models were unrepairable at the field. In fact, that winter I flew every Sunday but one—and that's saying something in Michigan. At any rate, I met my objective to fly both Quickie 500 and Quarter Midget the following summer. However, I never forgot my experiences with ½A and built several more models just to sport fly.

With all due respects to Ronald Sheen (designer of the Quickie 200) and Glen Spickler (who now kits the model) I found there were some things I didn't like about the Q 200—the great flight characteristics notwithstanding. The low wing (no wheels on ½A) was susceptible to snagging any rough spot on the field (I've since learned how to slow down models for landing), and the low-wing configuration made it difficult to hand-launch. The fuselage was also a little too tight for standard servos and anything other than a 225 mAh battery pack with foam protection. So I set about to create my own version of this type of model, using the same Ace RC foam wings

Photos by the author and Ken Linscott



Some people are crazy enough to fly during the winter . . . Of course, if you have a fleet of Supercats, it just might be worth it.



(thank you Owen Kampen—designer of the wings). The result of this development process is Supercat. You'll notice that the wing is elevated, although virtually in-line with the engine thrust line, and that the fuselage cross section is slightly larger. It's been called an upside-down Quickie—which it isn't. Subtle changes developed in the nose and rudder area; these were for balance and directional stability.

The model as shown flies every bit as well as the original Quickies. It is easy to launch, and there is plenty of room to install the radio. It even seems to point roll and fly inverted nicely, which I wish I could explain. My long time friend, Harry Roe, flew one of these models for over 500 flights while developing the Glo Bee ½A glow buttons for Fusite. Although Harry's model is getting very heavy, he's still flying it.

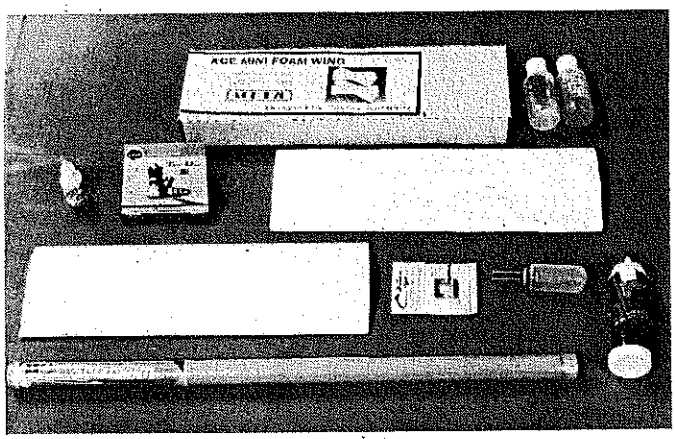
The Ace constant chord wing is the heart of Supercat, as it is on the Quickie 200 and several other models. Note that Ace also markets a tapered wing of similar material—however, I've never been real pleased with models I've flown with that wing. The wings are injection-molded foam that is somewhat denser than the more familiar expanded foam used in sheeted wings. The big advantage of this wing is that it saves a lot of time and weight in building. You simply have to install a trailing edge, glue in the dihedral, glass the center a little bit, strengthen the span with glass-filled strapping tape, and cover with low-temperature film. The price is right, too. The balance of the model is balsa and plywood, all of which can be bought for under $5 retail. Finish, covering, and hardware make for a fine model for under $20, less engine and radio.

Even though the wing is about an 18% section, with a good engine the model turns out to be very fast and is a competitive AMA-legal Pylon Racer with the optional canopy.

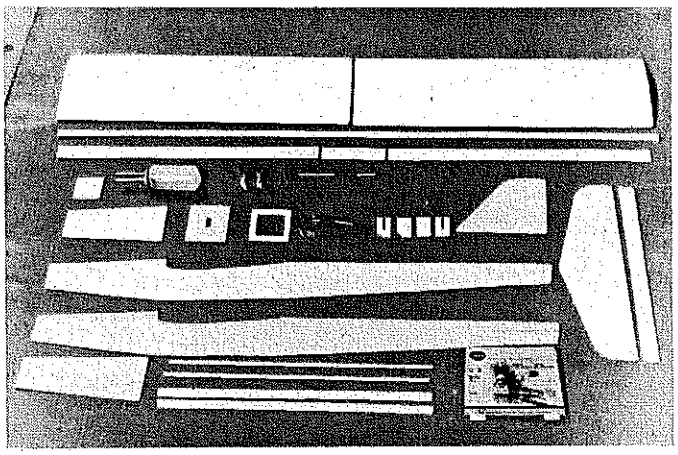
There are two secrets to successful ½A flying—light weight and a dependable engine. When commencing construction, keep in mind that you want to end up with a finished model weight between 20 and 23 oz. A 25-oz. model flies poorly, and the 28-oz. one I have (repairs add weight!) is a disaster.

If this is your first ½A model, you will have to maintain the proper perspective. Unlike a 6- or 7-lb. model, where a few ounces means nothing, each added ounce on a 20-oz. model increases

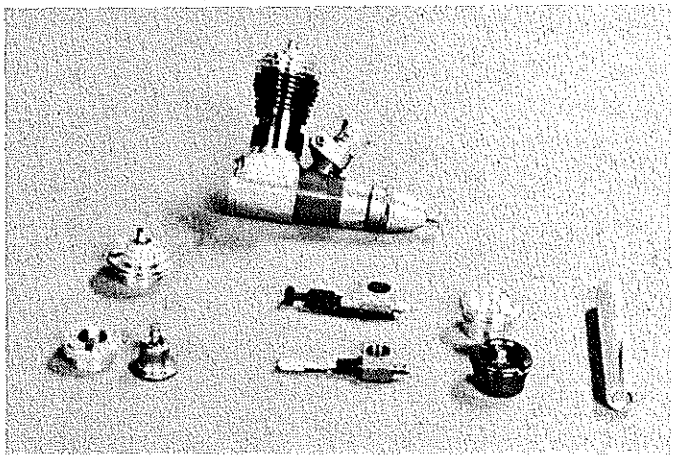
John applies a GloBee Stinger battery-powered electric starter to the nose of a Supercat. Author recommends GloBee glow plugs for the Cox .049 and .051 engines.



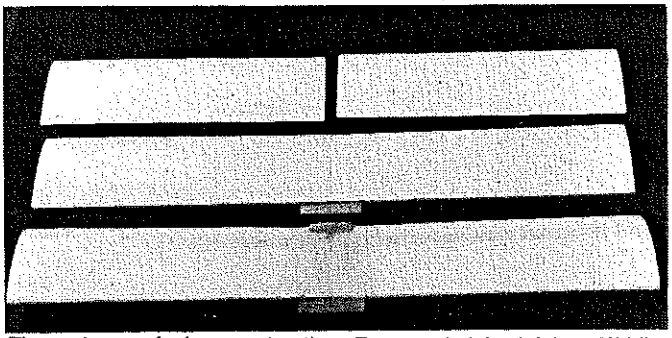
Here are the major components, except for wood. Ace RC foam wing, epoxy, CB engine mount, tank, Cox Tee Dee engine, and low-heat wing covering.



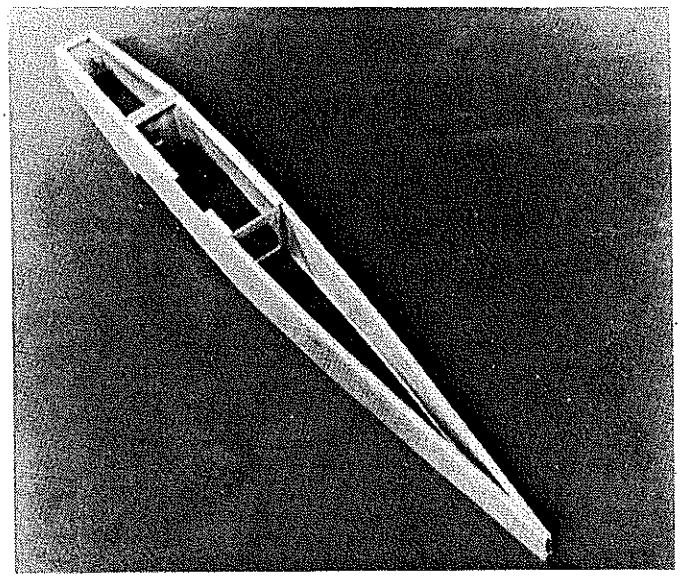
Here's the complete "kit" of Supercat parts. Wood components are easily cut and shaped. A quick-building, good-flying ship.



Tee Dee engine and recommended accessories. L to R, GloBee head, KK needle valve, KK pressure backplate, piston/rod reset tool.

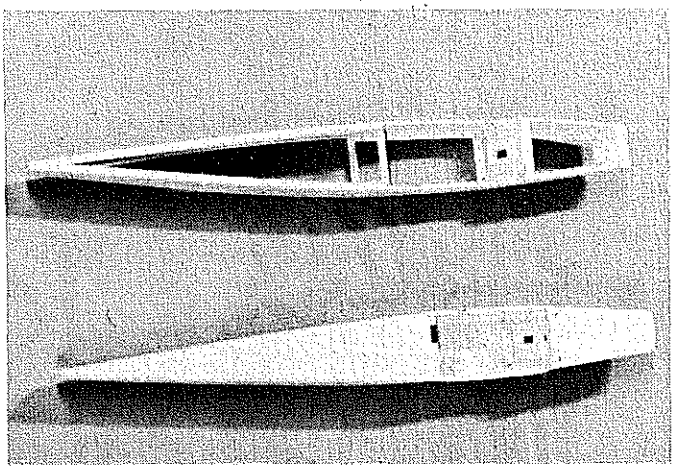


Three stages of wing construction. Top, sanded for joining. Middle, epoxied and trailing edge added. Bottom, epoxy and fiberglass reinforcement added along center line and strapping tape placed across bottom.



Bottom view of partially-completed fuse. Cutout is for elevator servo.

Top, partially-completed fuselage. The bottom shows it covered with sheeting and floor added in servo compartment.

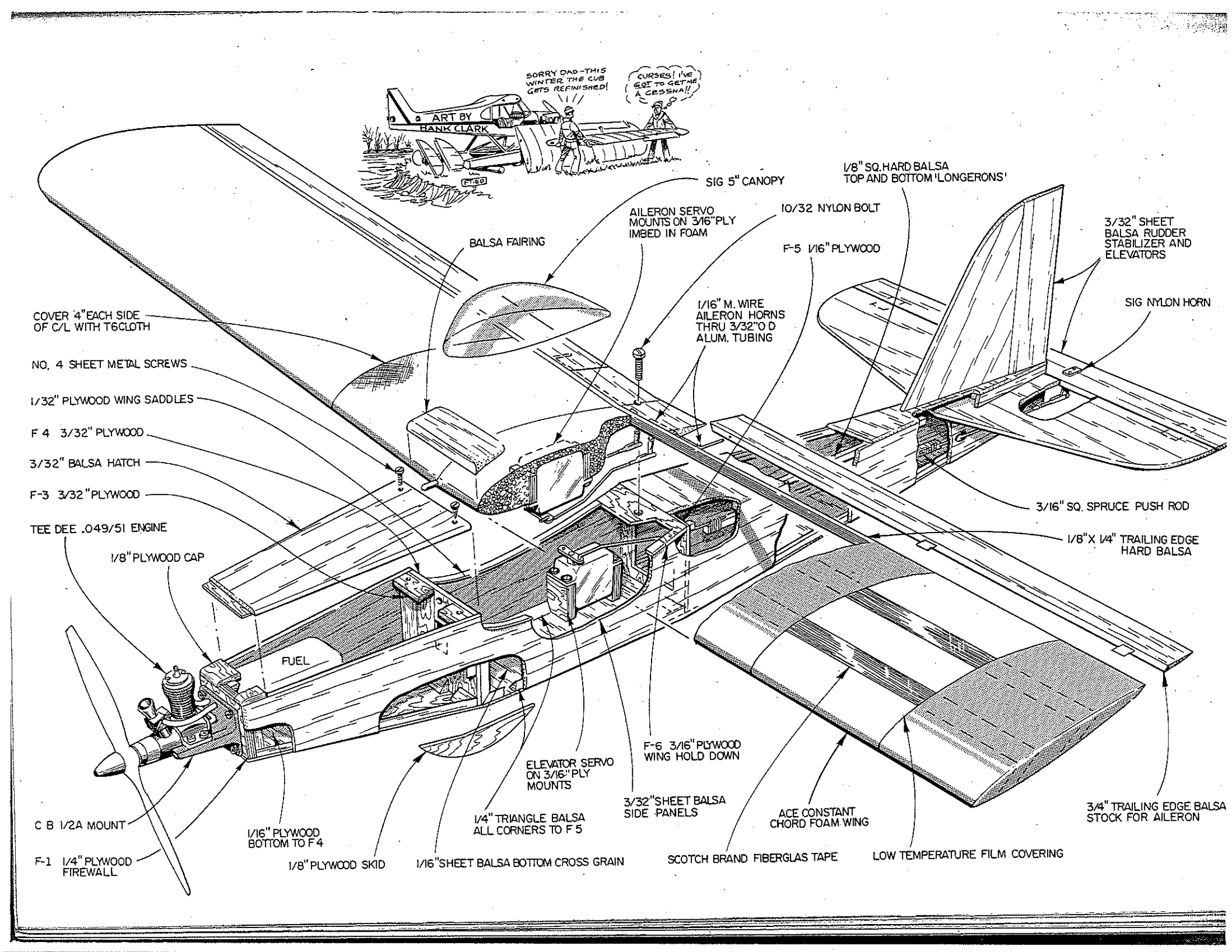


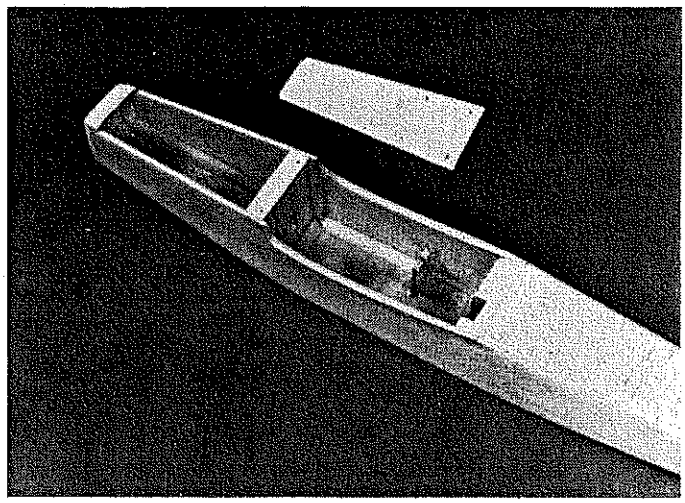
the wing loading by 5%. If you stick to the plans, use reasonable wood, and a moderate amount of epoxy, you should have no trouble coming out around 21 oz. The last three versions that I built had ¾-oz. glass cloth and resin covered with two coats of Perfect paint on all wood surfaces, and they weighed 21.5 oz. each, ready to go, with a 500 mAh battery pack.

Construction is straightforward. To start with, cut out all pieces as per the plans. Locate and glue F-4 and F-5 to the fuselage sides, followed by F-1, F-3 and F-6; then glue F-2. Use epoxy on F-1 and F-2 and also on all the triangle stock (do not omit this) in the nose area. Hot Stuff the ⅛ square to rear of fuselage sides. Lightly sand the top and bottom of the fuselage sides with a block, and put the fuselage aside. Glue the rudder pieces together and sand round all the edges of the rudder, stab, and elevator.

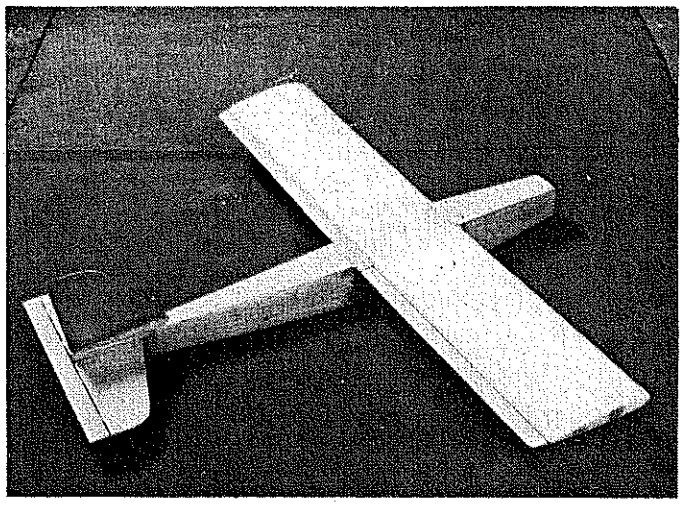
The wing is next. Cut or sand all flashing from foam sections using 220 paper. Then sand in the dihedral angle to give ½ in. or less total dihedral (¼ in. under each tip). Epoxy the two halves together, maintaining the alignment as close as possible to avoid a twisted wing. When dry, cut off the wing tips at the 30° angle as shown, cut out the servo mounting hole, and install the aileron servo mounts as shown. Be careful here to study the plan so that you get the proper fore-aft and side-to-side location of the servos. With an X-Acto knife, cut off the trailing edge of the foam wings until the thickness at that point is ¼ in. or very slightly less. Epoxy the ⅛ x ¼ balsa to the trailing edge. Use ¾-in. aileron stock to cut and fit the center section together. Break the center piece at the dihedral joint, and epoxy in place. When dry, lightly sand the entire wing with 200-grit paper. Add the strapping tape as shown. Use only Scotch brand fiberglass-reinforced tape, available at office supply stores.

Fabricate the aileron horns and tubing assembly as shown. Groove out the center section of the aileron stock to accept the horn assemblies, and

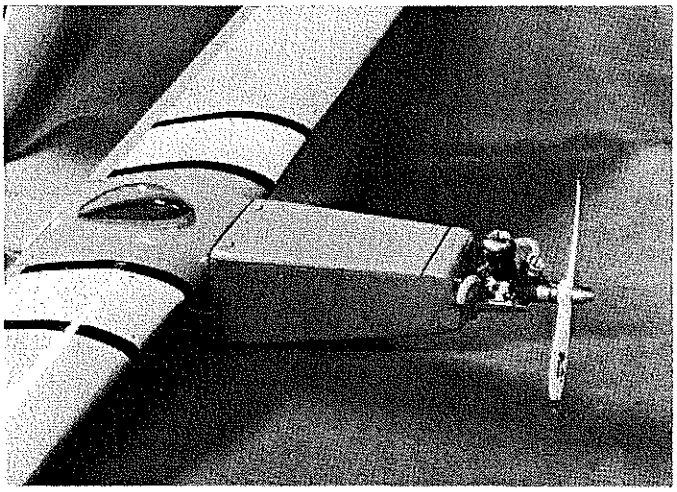

SORRY DAD-THIS WINTER THE CUB GETS REFINISHED!
CURSES! I'VE GOT TO GET ME A CESSNA!!
ART BY HANK CLARK
SIG 5" CANOPY
1/8" SQ. HARD BALSA TOP AND BOTTOM 'LONGERONS'
AILERON SERVO MOUNTS ON 3/16" PLY IMBED IN FOAM
10/32 NYLON BOLT
BALSA FAIRING
F-5 1/16" PLYWOOD
3/32" SHEET BALSA RUDDER STABILIZER AND ELEVATORS
SIG NYLON HORN
1/16" M. WIRE AILERON HORNS THRU 3/32" O D ALUM. TUBING
COVER 4" EACH SIDE OF C/L WITH TECLOTH
NO. 4 SHEET METAL SCREWS
1/32" PLYWOOD WING SADDLES
F 4 3/32" PLYWOOD
3/32" BALSA HATCH
F-3 3/32" PLYWOOD
3/16" SQ. SPRUCE PUSH ROD
TEE DEE .049/51 ENGINE
1/8" PLYWOOD CAP
1/8" X 1/4" TRAILING EDGE HARD BALSA
FUEL
F-6 3/16" PLYWOOD WING HOLD DOWN
ELEVATOR SERVO ON 3/16" PLY MOUNTS
3/32" SHEET BALSA SIDE PANELS
3/4" TRAILING EDGE BALSA STOCK FOR AILERON
C B 1/2A MOUNT
1/16" PLYWOOD BOTTOM TO F 4
1/4" TRIANGLE BALSA ALL CORNERS TO F 5
ACE CONSTANT CHORD FOAM WING
F-1 1/4" PLYWOOD FIREWALL
1/8" PLYWOOD SKID
1/16" SHEET BALSA BOTTOM CROSS GRAIN
SCOTCH BRAND FIBERGLAS TAPE
LOW TEMPERATURE FILM COVERING



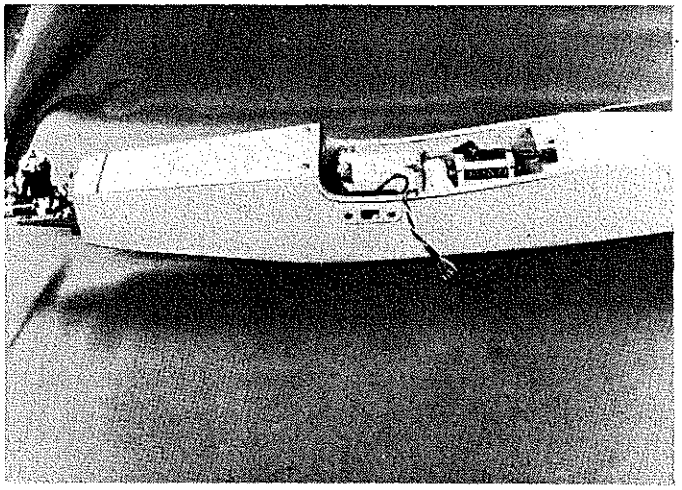
Note triangle reinforcing strips in front of servo compartment and along bottom. Notch in wing mount is for aileron pushrods.



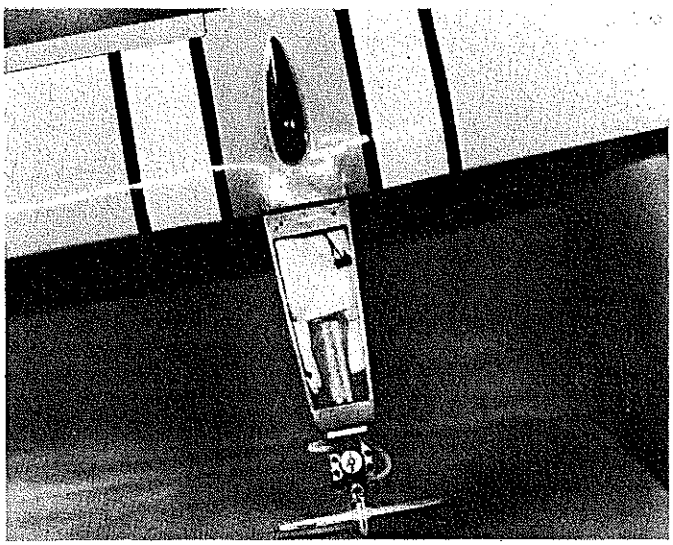
The complete Supercat, ready for low-temp covering on the foam wing and paint on the wood fuselage.



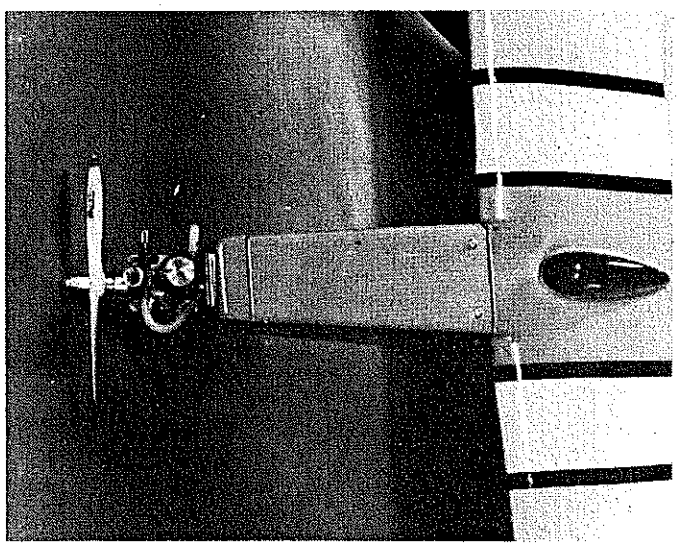
Front view shows smooth fairing of leading edge into fuselage hatch. Plumbing connects pressure backplate to fuel tank.



This view of the fuse with radio partly installed shows off the wing fillets. These cut down drag and provide a firm surface for wing.



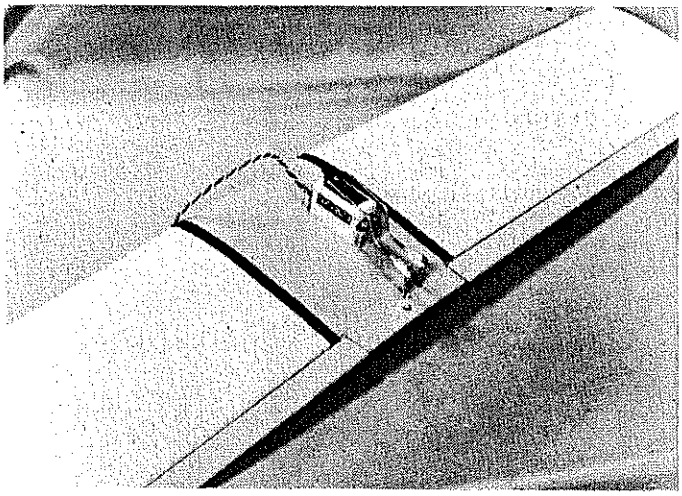
Tank and battery are carefully wrapped in foam. This avoids fuel foaming and loosening of battery connectors under engine vibration.



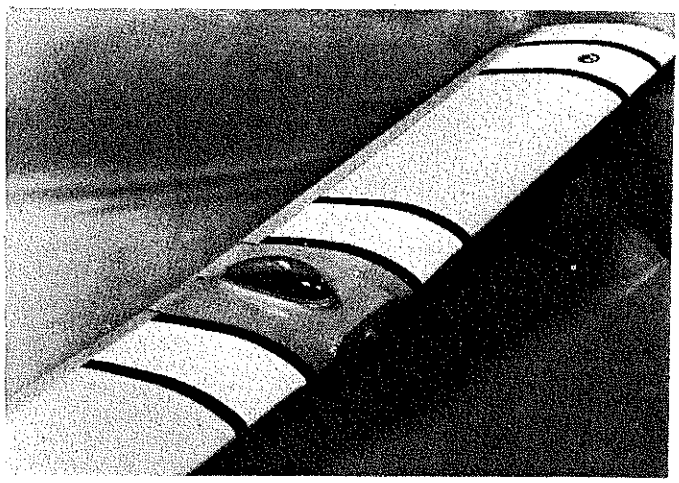
It's easy to tell that Supercat is a racing machine—everything is streamlined. Canopy makes it legal for AMA competition.

epoxy them in place along with the 3/16 dowel in front of the wing. Be careful not to get any glue in between the aluminum tubing and the wire on the horns. Using ¾-oz. glass cloth and Hobbypoxy Formula 2 (do not use polyester resin on the foam), coat the center section of the wing about 4 in. wide—top and bottom. Two coats of epoxy will probably be necessary. Sand well after each coat of epoxy, but be careful not to sand through the glass cloth.

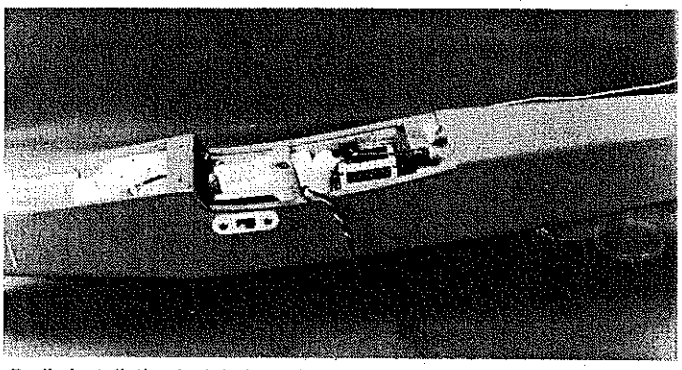
Now go back to make sure that the wing fits on the partially-assembled fuselage. Drill and tap F-6 for the wing bolt (or use a Tee Nut) and bolt the wing in place, making sure the wing is parallel and square with the firewall (F-1). When you are satisfied with the alignment, cut two pieces of 1/32 ply ¼ x 8 in. long, and soak them in water. Lay them on the fuselage sides to form the wing saddle, bolt the wing back on (tight), and adjust the saddles for alignment. They should be flush on the inside and overhang the outside of the fuselage sides. Carefully Hot Stuff them in place (making sure no Hot Stuff comes in contact with the raw foam—it will eat right through it).



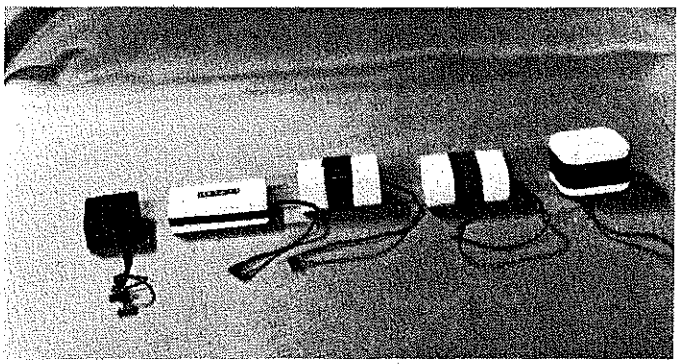
Servo is installed against spruce blocks epoxied into foam wing.



This view of a completed wing shows the dowel on the leading edge that fits into a hole in the fuselage former at front of wing saddle.



Radio installation is tight but adequate. Use small servos! Charging jack goes up under hatch so battery can be charged without removing wing.



Battery choices, L to R: 225 mAh, 450 mAh, 500 mAh, 550 mAh flat pack, 550 mAh square pack. All have been used successfully.

Remove the wing, and put a small bead of epoxy along the outside of the saddles to form a nice fillet. When dry, sand the edges of the saddles to clean them up.

Reinstall the wing and drop two vertical lines down on the fuselage sides, equal distances from the center of the leading edge and the center of the trailing edge. Measure down exactly 2 in. and draw a line to the rear of the fuselage sides. Use this to make sure that the stab has zero incidence (it should be parallel to the wing). Glue the stab in place, aligning with the wing when looking from the front of the model, and again making sure that it is parallel to the wing centerline.

Add the top and bottom fuselage sheeting, making sure that it is cross-grain as shown. Fabricate the hatch. Install the rudder squarely with the stab and on the centerline of the fuselage. Add the engine mount with 4-40 bolts and blind nuts. Install the hatch with No. 4 sheet metal screws, and sand the hatch corners and fuselage corners round to about a ⅛- to ¼-in. radius. Re-install the wing, and add the scrap balsa filler where the wing meets the hatch. Carve to shape, and blend in with micro-balloons and epoxy. Add 2-oz. fiberglass cloth in both directions around the firewall and about 2 in. back on the nose of the fuselage, using either epoxy or polyester resin.

Cut and trim the ailerons to fit. Add the ⅛ ply skid, and install the hinges on the ailerons and elevator. I use Rocket City strip hinges by making ½-in. slits with a No. 11 knife and Hot-Stuffing them in place, then pinning them with round toothpicks. I usually do this after resining the wood surfaces.

I prefer a painted finish, using ¾-oz. fiberglass cloth and two light coats of resin on all wood surfaces. Color with Perfect paint. You can also use MonoKote or a similar material. The wing must be covered with a low-temperature film such as Flite Kote, Solarfilm, EconoKote, World or Indy Film. I also prefer to paint the wing center section. No resin is necessary here, as it is sealed well with the Hobbypoxy, and polyester resin will not set up over slow-dry epoxies.

When the model is finished, install the ailerons using epoxy only on the front of the hinges where they go into the wing and epoxy only in the grooves where the horns attach to the ailerons. Do not Hot Stuff hinges where they attach to foam.

Install the switch, batteries, fuel tank, servos, and control horn. Fabricate a pushrod from 3/16 birch dowel or 3/16 square spruce. Set up all control movement for ⅛ to 3/16 in. up and down. Install the engine, prop, and fuel lines, and the model is virtually done.

The canopy is optional. It gives the model the 2 x 4-in. cross section required for AMA ½A Pylon Racing. The model should balance near the point shown. If not, add a small amount of lead shot to get the balance between 1¼ and 1½ back of the leading edge. This completes the model.

For engines, the Cox Tee Dees (.049 or .051) are in a class by themselves. They are the only ones recomended for this model.

There are several things you can do to improve the dependability and performance of the Tee Dee .049/.051 engines. As the engine performance is improved, so is the model's performance. I will attempt to list in stages the engine "tricks." Starting with an out-of-the-box engine, add a piece of silicone or latex fuel line over the needle valve threads where they go into the spraybar. This seals the threads, eliminating leaks that may cause erratic needle settings.

The next trick is a pressurized fuel system, which won't make the engine run any faster but will make it more consistent. This is best done with a Kustom Kraftsmanship pressure backplate. Consistency is further improved with a KK needle valve, which has a finer taper on the needle and 128 threads/inch for ultra-fine adjustment. I still use the fuel line seal on this assembly in addition to the nylon seal which comes with the KK unit. (Remember that any type of pressurized fuel system is not allowable in AMA ½A Pylon racing.)

We have found that the three spray holes in the venturi have too large a combined cross-sectioned area and can cause erratic needle settings. Harry Roe discovered that by simply plugging up two (any two) of the holes with cut-off straight pins, you can make the needle valve much easier to set. Press in the pins, and cut them off as close as possible, leaving the sharp ends protruding into the venturi throat. With any of the above changes you still have stock performance, but will have increased consistency and reliability.

Now come the performance boosts. These can be done in stages if you want to progress slowly. The addition of a Glo Bee head will give an instant 500 to 1,200 rpm increase. Note that there are two models (Sport and Race) available. The Sport version (5P) is generally more reliable and should be used for lower nitro fuels. The Race version (5R) is for 40% nitro, or more, and is the most durable; however, sometimes it is also more dependent on fuel and weather. Because these buttons are steel, you should use new copper gaskets each time you change them. Use at least two gaskets to keep the piston from butting the head. Before each engine run, retighten the cylinder head—this is a must. The balance of the performance improvements cannot be purchased short of buying a reworked engine—

Continued on page 99

For Fun/Winter *(Cont. from p. 62)*

framed it with cardboard, Marvin thinks, then chopped lightening holes, added a long stringer on both sides to eliminate the square look, and covered as usual, it would have been stronger and lighter and could have been done in two nights at $2.00, plus covering.

Such kits would be a cinch. Just sheets of material and patterns. People have demonstrated how to get cambered surfaces from both core-board and corrugated cardboard. We once saw a Bridi .60 cabin job on the field—lovely, but so what? Later, playing back video, we heard a background conversation. It was foam-core board! Good paint job. You'd never know the difference. Ron St. Jean has bonded silkspan-like paper to hot-wire cut cores that stand up to big comp Free-Flight stresses. Composites are coming. *(Editor: An article by Ron St. Jean describing his processes will appear in this magazine as soon as it can be scheduled.)*

The Joe Ott caper. Joe is back in business. The man who turned us on during the Twenties with Rubber Scale jobs in *Popular Aviation* might just shake up the industry. We expect to have details next month. He's got a radio system with never-seen-before features. And a trainer which assembles on jigs. Very advanced features and techniques. Not scratch-built, either. For example, molded cabin has pilot painted on. Nifty removable motor mount allows replacement with bigger engine in minutes. Two wings, for calm or windy weather. Four channels. He die-cuts *printed* sheets. A remarkable product, a remarkable man. At 83, he sounds like a 20-year-old. He was walking before the Wrights flew at Kitty Hawk. A pre-run kit is on the way.

Spooky stuff. In mid-1800s, Henson's 150-ft. Aerial Carriage. Experts say it might have flown given a suitable power plant. Construction equalled 1900-era stuff. It had modern features, including trike gear. They laughed him to scorn. His friend, John Stringfellow, for years tried to prove the concept by a series of models (about 20 ft.) powered by his own model steam engine (not enough power). That steam engine, about 1½ feet tall, developing about one horsepower, is on exhibit at the National Air & Space Museum. (Stringfellow was the first to build a workable model airplane power plant; if Langley is the father of power Free Flights, Stringfellow is the father of our engines.) Henson had two full-size versions in the Aerial Carriage. Many years ago, the Smithsonian bought one of them in England. That great institution ordered the priceless power plant shipped to America. On the Titanic.

Bill Winter, 4330 Alta Vista Dr., Fairfax, VA 22030.

Supercat/Kilsdonk

Continued from page 35

except for fuel.

The following do-it-yourself steps will each add small benefits, depending on your particular engine. Drill out the venturi to 5/32-in. diameter (still use the pins). Lap the crankshaft to the crankcase. Lap the piston and cylinder fit, and alter the crankshaft and cylinder timing. A more detailed "how-to" description was provided in a 3-part series by Joe Klause in *Model Builder* magazine. They all work if done properly.

Now, back to purchased horsepower—fuel. Ordinary 5-15% sport fuel will not give very good performance in a ½A. By adding propylene oxide (up to 10%), you can really bring it to life. It provides the extra heat that ½As love. They also respond very well to additional nitromethane.

Continued on page 100

I would recommend the following guidelines:

Use	Oil (Ucon) %	Nitro %	Propylene Oxide %	Methanol
First Flights	20	10	10	60
Sport	20	25	5	50
Race	20	40	3	37
Ultimate	20	60	3	17

If you prefer not to play chemist, you can purchase premixed fuel. Cox fuels are fine, but they have lower nitro contents. If you prefer higher nitro fuel, Nitrotane ½A blends all contain adequate propylene oxide.

The last hot tip is to frequently check the conrod ball socket fit in the piston. After disassembly, grasp the piston and push and pull on the rod. If you can feel or hear it move, it is too loose. This can be easily tightened using a KK reset tool. I recommend doing this after each flying session.

I've found that the Top Flite 5¼-in. nylon props give the best all-around performance. You can experiment with various props to suit your individual taste.

Following is a list of specialized products. Send SASE for info.

KK Products (needle valves, pressure backplates, reset tools, reworked engiens, and parts): Kustom Kraftsmanship, Box 2699, Laguna Hills, CA 92653. (Also available from Ace RC and some hobby shops.)

Nitrotane Fuels (½A blends with propylene oxide): Space Age Fuels, RR 3, Kewaunee, IL 61443. Phone: (309) 853-9606. (Also available from some hobby shops.)

GloBee Heads: Twinn-K Inc., P.O. Box 31228A, Indianapolis, IN 46231. Phone: (317) 839-6579. (Also available from KK, Ace RC, and most hobby shops.)

Flying the Supercat is easy. It has no bad habits, and it grooves very well. A very gentle straight-ahead hand-launch will get you in the air. I prefer to launch my own by holding the transmitter in my left hand and launching the model with my right hand. If you're a little leery of trying this, do it with some added up-trim first. Be sure not to point the nose high as you launch. Remember, straight ahead into the wind, using only some wrist action. Landings are easy, and with a little practice you can grease it down on the skid every time. The only trick is to keep it upwind and a little high at the end of the tank to allow for the proper setup for landing.

We usually carry a ½A model with us whenever we go out of town to a Pylon Race, for just sport flying and general horseplay in the evenings if we visit a flying field. When we attended the 1979 Nats in Lincoln, NE we naturally had a Supercat along. One evening after an exceptionally frustrating day of Formula I, we decided to take the Supercat over to the local flying field.

Upon arriving, we were graciously greeted by a member of the Sky Knights Club. We asked if we could sport-fly, and he said sure, and went on to explain their local field rules. Then he wandered back down to his buddies and resumed his flying. We got the frequency clip and got Supercat fueled and into the air. We went through our usual routine: self-launch followed by some very low high-speed passes from split-S maneuvers, where the engine will unload up to 33,000 rpm, ending up with a spot landing at our feet. This brought a group of the local fliers over to inquire as to what kind of engine we had. "Cox," we replied. They wanted to know where we bought it

—thinking it was Cox's proposed .40. When they discovered it was only an .051, they just stood there in disbelief.

Then I let my flying partner, Denny Sumner, fly it. He did a whole flight of rolling circles, from takeoff through dead-stick landing, with the final roll less than 50 feet before touchdown at his feet. All during the flight, we had the crowd believing that the aileron servo had locked in full right.

After that, we held a small clinic on ½A flying with the local club members. It apparently was quite an experience for them, since they had never seen an aileron ½A with a hot engine.

I hope you can experience the fun of ½A as I have. Happy flying.

Radio Technique/Myers

Continued from page 29

walk off and leave something on charge.

I wrote this column at a time when I expect that you'll be reading it about Christmas, so I'll wish you Season's Greetings with the hope that Peace on Earth will become a reality soon. Keep the letters flowing. *(Editor's note: Publication of this column was delayed a month from the time George expected it to appear. That's why you're reading it* after *the holiday season. RMcM.)*

George M. Myers, 70 Froehlich Farm Rd., Hicksville, NY 11801.

RC Scale/Wischers

Continued from page 39

Most versatile in number of uses is the Detail/Touch-Up gun used by specialty auto paint shops. It can cover spray patterns from ½-in. to 3-in. width, depending upon the size nozzle tip that is used. Its cup will hold paint for one side of a large wing, which means more frequent refilling. Its advantage is light weight, easy manipulation, and flexibility. Its disadvantage is high cost.

Lowest in cost is the single-action, external-mix airbrush. For maximum versatility there are three sizes of spray tips to cover areas from ⅛-in. to 2-in. diameter. Depressing the button releases air and fluid simultaneously. There is no provision for changing the spray pattern from round to oblong, as in the larger guns. Because of the small area, even with the largest tip, it is very difficult to get uniform density of color. Best use for this airbrush is in spraying small areas of trim color after masking. We have found the single-action airbrush useful for large areas only with paints such as Floquil. It is simply not practical for doping the full area of a complete model.

For camouflage or weathering, the double-action, *internal-mix* airbrush has no equal. This brush is really different in that air and paint are mixed inside the spray tip for thorough atomization, resulting in almost complete elimination of over-spray. Depressing the button releases air; moving the button rearward controls the quantity of liquid and spray diameter. Don't expect to learn the technique on your recently-completed, super-Scale model. It takes patience and development of skill. Another disadvantage of an internal-mix spray tip is the frequent cleaning required when using fast-drying materials.

For our purposes, in RC Scale, there is a variant of the internal-mix airbrush that is single-action. The button releases both air and paint, but the paint quantity is easily variable by a secondary control at the rear tip end of the airbrush, not continuously variable as in the double-action device. It is less difficult to master operating techniques, and the paint density re-