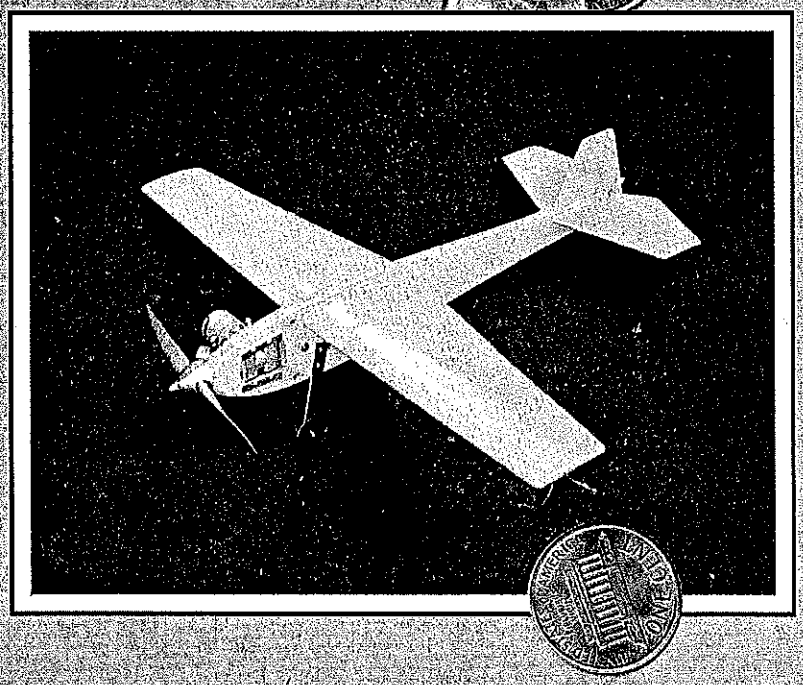
#777

Special YOUTH ISSUE

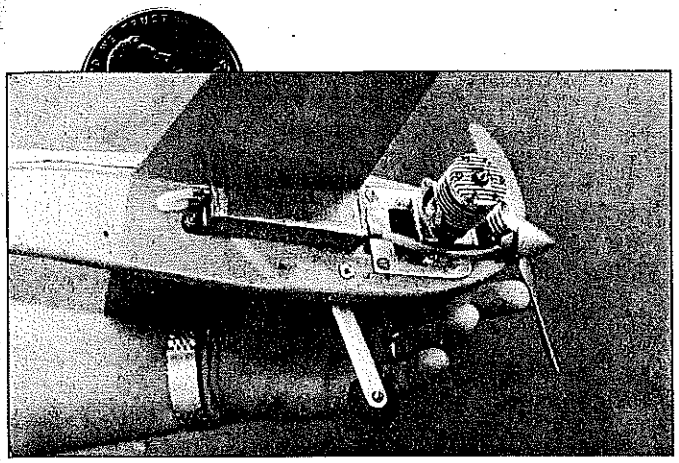
Ten Penny Speed Trainer

This .21 Sport Speed trainer makes a lot of "cents"

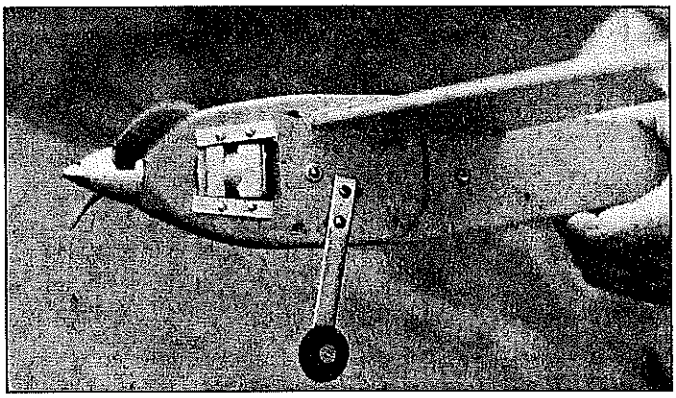
■ Glenn Lee



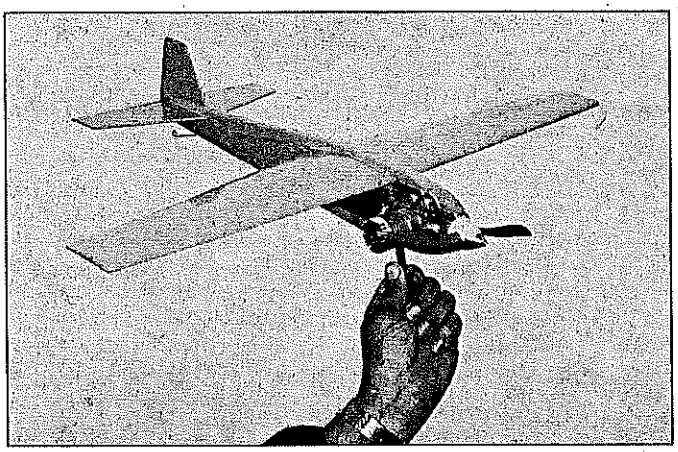
Are you looking for a relatively easy Control Line competition event for yourself, for your kids or grandkids? Aerobatics takes a lot of practice and involvement; Racing and Carrier are high technology, with such things



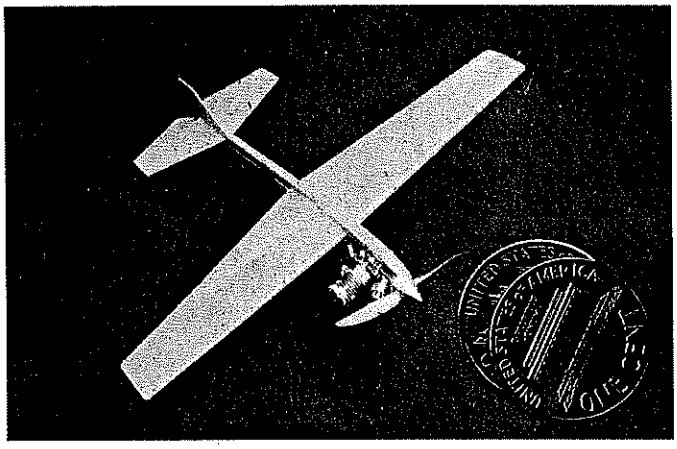
Homemade brass tank holds about one ounce of fuel. Aluminum plate under engine absorbs vibration and increases rpm.



The landing gear can be a simple sheet of aluminum or titanium (as shown) or round music wire can be used.



K&B .21 starts easily on crankcase pressure, runs steadily, and does well over 100 mph on an APC 7 x 6 prop.



The profile-fuselage Ten Penny is not a fancy model, but it is very effective. Spinner looks neat, helps starting.

as shut-offs and throttles; but Speed is simple: you just have to take off, get in the pylon, and fly level. All you need is a good engine and a stable airplane.

Why don't you look over this speed trainer for .21 Sport Speed? It's easy to build, easy to fly, there are several good engines available to power it, and some of them are quite inexpensive.

Our present AMA rules for Sport Speed allow profile models to be flown in competition, so you do not have to build a fancy Speed model with magnesium pan, streamlining, monoline, tuned pipes, or other trick stuff.

This would be an excellent model for Juniors or Seniors to fly at next year's Nats. There are usually only a few entries, so any successful flight has a good chance to win a trophy.

You can start with an inexpensive engine, and if you like the event you can get a faster, more powerful one and put it on the same airplane. This model will go 100+ mph with a good engine, so don't think it's a pansy!

The single wheel doesn't add much drag, it makes takeoffs simple, and it saves props.

If you are an experienced builder you won't have any trouble building this model, but I'll try to explain everything so a

Ten Penny Speed Trainer

Type: CL Speed

Wingspan: 23 inches

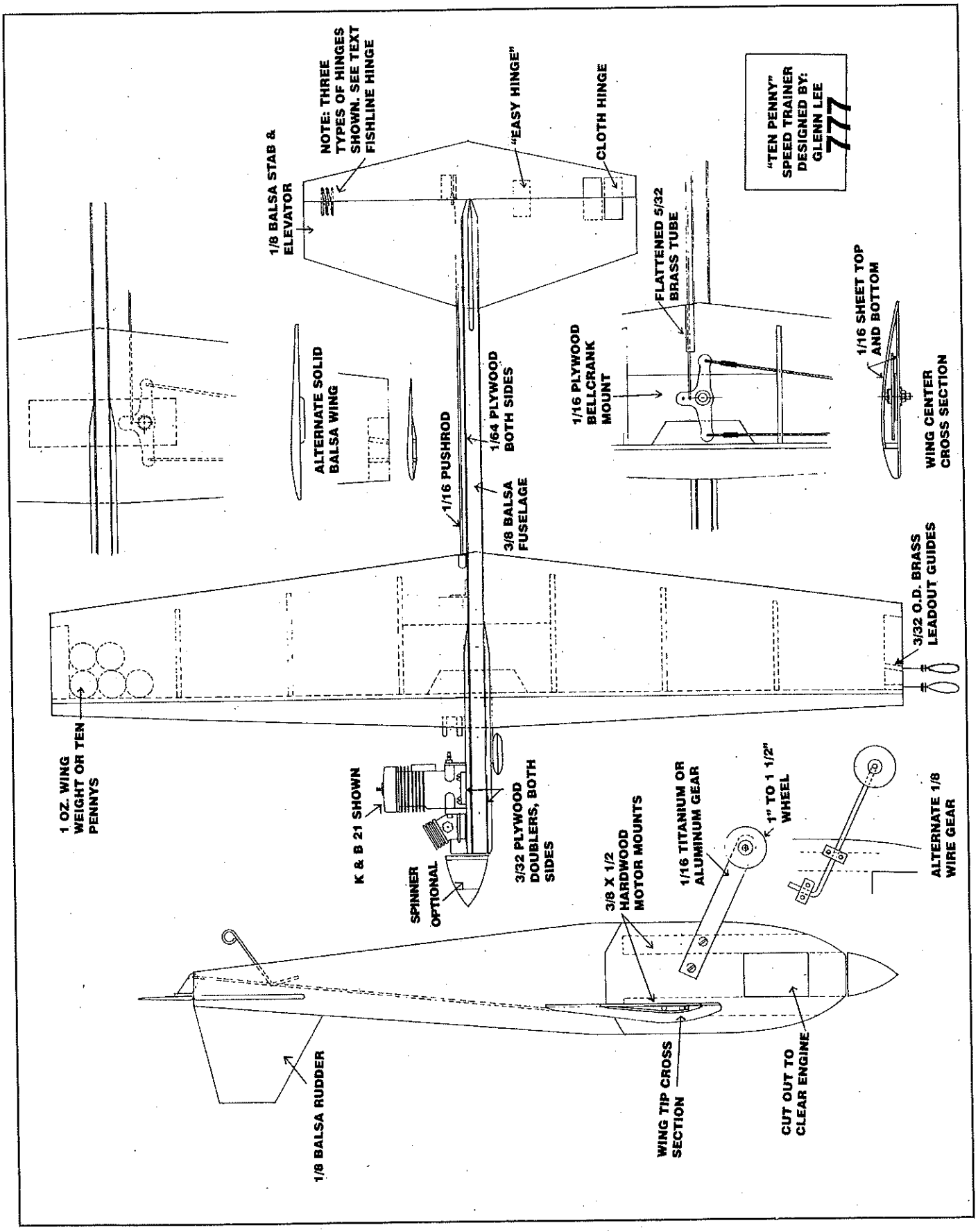
Engine size/type: .21 glow

Flying weight: 20 ounces

Construction: Solid balsa or built-up wing

Covering/finish: Epoxy and/or iron-on film

After flying Ten Penny, Stunt/sport racing flier Skip Spoula and sons Ryan and Matt are ready for Speed competition.


"TEN PENNY"
SPEED TRAINER
DESIGNED BY:
GLENN LEE
777
NOTE: THREE TYPES OF HINGES SHOWN. SEE TEXT
FISHLINE HINGE
"EASY HINGE"
CLOTH HINGE
1/8 BALSA STAB & ELEVATOR
ALTERNATE SOLID BALSA WING
1/16 PUSHROD
1/64 PLYWOOD BOTH SIDES
3/8 BALSA FUSELAGE
FLATTENED 5/32 BRASS TUBE
1/16 PLYWOOD BELLCRANK MOUNT
1/16 SHEET TOP AND BOTTOM
WING CENTER CROSS SECTION
3/32 O.D. BRASS LEADOUT GUIDES
1 OZ. WING WEIGHT OR TEN PENNYS
K & B 21 SHOWN
SPINNER OPTIONAL
3/32 PLYWOOD DOUBLERS, BOTH SIDES
3/8 X 1/2 HARDWOOD MOTOR MOUNTS
1/16 TITANIUM OR ALUMINUM GEAR
1" TO 1 1/2" WHEEL
ALTERNATE 1/8 WIRE GEAR
1/8 BALSA RUDDER
WING TIP CROSS SECTION
CUT OUT TO CLEAR ENGINE

beginner can understand how to do it.

CONSTRUCTION

Look the plans over carefully before starting to build, and then decide what part you want build first. I usually start with the fuselage so that when the glue is drying I can work on other parts.

Pick out a piece of good, firm (but not rock-hard) 3/8 x 3 balsa and buy or saw out the hardwood engine mounts. These can be 3/8 square or 3/8 x 1/2—just be sure they are the same thickness as the fuselage balsa.

Saw the slots for the mounts with your jig saw or band saw so the distance between them fits your engine, and try to get a reasonably close fit. If you don't have a power saw, just use an X-Acto knife and trim to fit.

Notice that on the plans I show a full-length plywood sheet on both sides of the fuselage extending under the nose doublers. This plywood can be either 1/64 or 1/32 and it greatly increases the strength and crash resistance of the fuselage. It is well worth the extra effort. Cut the plywood at least 1/2 inch oversize all around, you can trim it to the shape after gluing.

Glue the two sheets and the engine mounts to the fuselage with epoxy or aliphatic resin woodworkers' glue and clamp or weigh the assembly down on a thick piece of plywood or other flat surface. Put waxed paper down first so you don't glue the fuselage to your board!

After the glue has set or is dry, trim the excess thin plywood sheets to the shape of the fuselage. Now you can add the 3/32 plywood doublers to the front. Cut these two pieces to shape and taper the back edges to streamline them a little and make them blend into the fuselage.

Before you glue the doublers to the fuselage, locate their position accurately one at a time by pounding a small nail or brad through the plywood and a little way into the fuselage. These nails will hold the pieces in place when you glue and clamp them. Remove the nails after the glue is dry and then round all the corners, test-mount the engine, and streamline the nose area.

Wing: If you cannot build or are hesitant to build the hollow wing shown, you can use solid balsa and mount an external control system. A solid wing can be thinner than the built-up wing, since the bellcrank doesn't have to be inside. The hollow wing is probably faster in the air, even though it is thicker; external controls add a lot of drag, and the built-up wing looks a lot neater.

Whichever wing you decide to build must be strong. My model weighs 20 ounces with the K&B .21 engine, so the pull test will be 60 pounds. The wing-to-fuselage joint must also be able to take this pull, so you have to take extra pains to make this joint capable of taking the load.

If you decide to go with a solid-balsa wing, cut it to shape from medium or heavy 1/4-inch wood and carve it to the airfoil shape with a block plane or carving knife and sanding block. The airfoil can be flat-bottom or symmetrical; either will fly okay, and you can change the profile shape to anything you prefer—just keep it about the same size.

After the wing has been sanded, glue the center 1/8 plywood reinforcement and the leadout guides in place. Carve a hollow for the wingtip weight.

The wingtip weight is necessary to keep the airplane from rolling in at you on takeoff. You must use .020 diameter solid music wire lines 60 feet long to meet the rules, and they are heavy.

About one ounce of weight is enough. It can be a chunk of lead that hobby shops sell, or it can be any combination of washers, lead shot, or coins that are about the right weight. Use a postal scale to measure it, even if you have to go to the post office or a grocery store to use their scale! One ounce is equivalent to about ten pennies; that gives you an idea where the name of the airplane comes from.

Epoxy the weight near the outer wingtip, and smear glue all over the weight—you don't want it coming loose. Glue a piece of fiberglass cloth over it to make sure it stays in place.

To build the hollow wing, start with a sheet of 1/16 hard balsa cut to the shape shown; either buy a piece wide enough or splice narrow sheets together with "instant" (better known as cyanoacrylate or CyA) glue. The

thickness of the wing varies from about 1/2 inch at the center to about 1/4 at the tip, to reduce frontal area.

The 3/8 x 1 leading edge is probably easier to taper after assembly, so glue it in place on top of the sheet. While the glue is drying, cut the 1/8 thick piece that goes just behind it. This strip makes it easier to put the top sheeting on, so taper it from 1 1/32 high at the center to 3/32 at the tips and glue it against the back of the leading edge with CyA.

Glue the 1/16 plywood center reinforcement sheet in place. Be *sure* you do a good job—all of the pull-test load goes through this part.

Cut the ribs from 1/8 balsa sheet by making a cardboard or thin metal template to the shape shown on the plans. All of the ribs have the same top curve; just vary the height to match the support strip just behind the leading edge.

Glue all of the ribs in place, then get your bellcrank and leadouts ready. These items and the tip weight have to be installed before you put on the top sheet.

The bellcrank can be any commercial 1 1/2-inch unit or a larger one cut down, and the leadouts can be the heavy braided type of cable or solid 1/32 music wire. Just be sure that the loops are well wrapped and soldered securely, remove all soldering flux with hot water and soap, and coat the joints with oil so they won't corrode later.

Run the leadouts through two 1/2-inch-long pieces of 3/32 O.D. brass tubing before making the end loops. Make each leadout the same length so that you have an external reference of bellcrank position after the wing is completed.

Bolt the bellcrank in place with a 6-32 bolt that comes out of the bottom of the wing. The nut and screw extension will be epoxied into the fuselage to help take the pull test. Cut notches in the wing ribs where the leadouts go, and epoxy the brass leadout guides into the wingtip.

The pushrod is 1/16 music wire, and it exits the wing through a flattened piece of 5/32 O.D. brass tubing. It's flattened so there is room for the wire to move when the bellcrank is rotated. If you don't use this tube you end up with a big slot in the wing where fuel can enter. Leave the pushrod long enough so you can bend the end for the control horn in final assembly.

Install the bellcrank, leadouts, and pushrod assembly. Epoxy the flattened tube to the trailing edge, and be sure nothing binds when you pull the wires.

Now comes the only tricky part of wing construction: getting the top 1/16 sheet balsa to fit properly before gluing.

Lay the wing on your flat building board and sand the trailing edge to blend into the ribs as shown on the wing cross- section drawing. This lets the top sheet extend past the bottom sheet, and you can trim the excess off later. Use a sanding block to sand the bottom sheet so the top and bottom sheets will match all along the trailing edge.

Cut a piece of three-inch-wide balsa a little longer than the wingspan and lay it atop the ribs. The front edge of this strip will probably have to be trimmed so that it mates to the leading edge when each side is bent down. You end up with a slight curve on the front edge, and to get it right you lay the sheet on the ribs, bend and pin it down, and see how much you have to trim. Don't worry if you end up with some small gaps; you can fill them later.

After you get the top sheet to fit, apply woodworkers' glue to the leading edge shelf, all the ribs, to the trailing edge where the sheet touches, and pin it down with lots of pins. Now use the same technique with another (narrower) piece to finish the rear section. Use a rat-tail file to make the groove to clear the pushrod guide. Take extra pains to get the joint between the two sheets to match closely. After everything is dry, trim and sand the trailing edge and leading edge (make the leading edge round).

Stabilizer and elevator: The stab and elevator are cut from good 1/8 balsa: don't use super-soft stuff. Cut to shape, sand all the edges round, and taper the trailing edge of the elevator.

Pick your choice of hinges from the three shown—any of them will work. I still use cloth hinges glued with Ambroid, but I also like the Easy Hinge sold by Sig and other suppliers. The Easy Hinge or the nylon fishline type allows you to install the hinges after everything is finished and painted.

If you use the nylon fishline, drill the holes first, string the line on a needle, and sew the line through the holes, going from top to bottom so you end up with the line crossing at the hinge gap. Align the stab with the elevator and glue the line in place with CyA.

Cut the rudder from the same balsa as the stab, round the leading edge, taper the trailing edge, and glue it straight on the fuselage. Be sure there is no rudder offset.

Final Assembly: Use a pencil or pen to lay out the position of the wing and the stab on the fuselage. Be sure the stab is at 0° incidence to the bottom of the wing. Cut or saw a 1/8 slot for the stab on this line.

Make a cardboard template of the wing cross-section and slide it onto the wing, trimming as necessary until it fits at the center. Trace this cutout onto the fuselage at the proper distance from the nose, and use a jigsaw to cut out this section.

Slide the inboard side of the wing into the slot and mark any area where it interferes. Remove the interfering wood with a half-round rough file, and repeat the trial until the wing slides snugly all the way in. Use a grinder or chisel to cut out a little wood where the bellcrank bolt extends below the wing.

Center the wing, make sure it is square longitudinally by measuring from the wingtip corners to the rear of the fuselage, and hold a square under the wing against the fuselage. When all is lined up, apply some CyA in several places at the wing-fuselage joint and hold until they set.

Fill the joint with glue, epoxy the cavity where the nut and bolt are, and be sure the wing is completely glued to the fuselage. CyA is fine for close fitting areas—it will "wick" (flow) down into the joint—but if you have a gap, use epoxy and work it down into the opening.

A fillet of some kind will increase the strength of the wing-fuselage junction. Glue a 1/4 x 45° balsa strip under the wing or apply a filled epoxy fillet all around the junction on both sides of the fuselage.

Slide the stab into its slot, square it up to the fuselage, and glue it in the same way as the wing.

Finish: Now you can sand the entire airplane, round off any remaining corners, and fill any dents with Model Magic filler. Leave the trailing edge of the wing square; there's less drag that way than if you would round it off.

When you are satisfied with the way the model looks, decide what kind of finish you want to apply. There are several types, and each has advantages and disadvantages.

An all-dope finish is lightweight, not very fuelproof, and needs several coats; the finishing epoxy resin is fuelproof, but it's heavy and difficult to sand.

I would recommend an epoxy finish—either K&B or Hobbypoxy. Apply two coats of primer surfacer, sanding between coats, and then a coat of colored epoxy. You want a lightweight finish, so sand most of the primer coat off before painting.

If you have a sprayer, by all means use it; a brushed finish is not as smooth as a sprayed one. Be sure you have a good coating around the engine and tank area to keep fuel and oil from soaking in. An alternative is to paint the fuselage and cover the wing with an iron-on plastic covering, and seal all edges with CyA.

After the paint is dry, install the control horn on the elevator, glue in the tail skid, and bolt on the landing gear. The landing gear can be made from a bent piece of 1/8 music wire (clamped to the side of the fuselage with nylon retainers from the hobby shop) or a flat strip of 1/16 titanium or aluminum filed to a streamlined cross-section.

The flat gear has a lot less drag, but you can start with the wire gear and change it later for more speed. It all depends on what resources you have or want to buy.

After you become proficient in flying, you could even remove the landing gear, put a skid on the bottom of the fuselage, and hand-launch the airplane! We used to do that all the time, before we had takeoff dollies. Whichever gear you use, put it on the left (inboard) side of the fuselage to maximize the effect of the wingtip weight.

Bolt in the engine with some out-thrust for the first few flights by putting a couple of washers under the front hole of the engine

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Ten Penny/Lee

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mounting lug. After you have learned how to whip the model a little for takeoff, these washers can be removed.

If you have some 1/16 aluminum sheet, saw out a plate to support the engine. It will absorb some vibration and stiffen the front end, which will give more rpm.

Tank: A simple all-metal tank running on crankcase pressure works just fine; an ounce of fuel will be more than enough. Keep the tank narrow to minimize the effect of the changing fuel level. Find a suitable tank in the hobby shop or make one out of a clean tin can. Even one of the small plastic RC tanks will work. Clamp the tank to the fuselage with J-bolts and rubber bands or a bent strip of tin and self-tapping screws.

You need to buy a pressure tap for the engine that will either replace the upper left-hand backplate screw or one that will require you to drill and tap a hole in the backplate. There are 4-40 and 6-32 sizes used for RC muffler pressure, so most hobby shops have them.

Flying: Run the engine a few times before flying to become acquainted with starting and the needle-valve setting. Almost all of the .21 engines are ABC, so they need little or no breakin. There are plenty of good props available, so start with a 7 x 6 or 7 x 5 APC or wood type.

Test fly! You will probably find the fastest prop will be something like a 6-1/2 x 5, but it will depend on your engine and how cleanly you built your airplane. Use good, commercial 10% nitro fuel like Sig's.

A spinner is really not necessary, but it looks neat and works easier with a starter. A rounded prop nut is all you need.

Supplies: Very few hobby shops carry Control Line equipment any more, so here are a few suppliers for lines, handles, clips, etc.:

General products, engines: Sig Mfg. Co., 401-7 S. Front St, Montezuma IA 50171; Tel.: (515) 623-5154.

Lines, neat bellcranks, clips: Ned Morris, 9044 Rushmore Blvd. South, Indianapolis IN 46234; Tel.: (317) 271-1231.

Variety of Control Line products: Bear Necessities, Box 549, Beecher IL 60401-0549.

If you have problems or need help, write to me. Glenn Lee, 819 Mandrake Dr., Batavia IL 60510. ✈