TRAYS VITE

By Roy L. Clough, Jr.

If this was the kind of fantasy world where I could have my druthers you, the reader, would know practically nothing about model airplanes. Maybe you never even folded up paper gliders.

You'd have just picked up *Model Builder* because it prodded your curiosity about midget airplanes that fly with a little help from their friends.

I'd consider that terrific. It would give me another shot at that deep down satisfaction of introducing somebody to a lifelong creative adventure.

Model airplanes really *are* all that great. Why? Because that mechanical bird flying around up there, that collection of sticks and stuff you glued together, is your baby. Doesn't matter if a thousand like it have been built to the same plan by a thousand other people. Each one reflects the unique personality of its builder, and this one is yours. You've been shop foreman, assembly crew, mother, father, midwife and finally test pilot to that little mechanical entity flying around out there with a life of its own.

Hey, get real. *Life?*

Yeah, life. Think about it. That little machine has a functional body shape with systems and "organs" adapted to its environment. You've built a fair, if over-oversimplified, mechanical analogy of a living entity. It has to "eat" to "live." It consumes energy stored in fuel, batteries, rubber bands or pressurized gases. It reacts to what happens in its real world by responding with its built-in survival characteristics. Finally, granted "consciousness" by radio control, it can respond to the commands of its creator.

How about that? You get to play God for the price of a bottle of glue and few scraps of wood and plastic!

Sounds like deep-down fun, but you won't get there for nothing. You'll have to ante up and make a commitment of some of your precious time. You have options. You can lay out fairly important bucks for an ARF, a plane that is just about ready to fly (but never as ready as you hoped). Or, for a bit less, buy a kit, a box of pieces easy to glue together (never as easy as it seems). Finally, if the grade on either of these routes seems too steep, you can go from scratch.

Scratch? For a beginner? Isn't "scratch" building the toughest way of all? Not necessarily. In fact, scratch can be the *easiest* way to get into model building. Find a good set of simple plans and build your plane one stick at a time from raw materials. Go at your own pace. Be ready to forgive your own mistakes; nobody is born with the skill and patience to assemble a big, complex model on the first try. That kind of savvy and confidence is built on a foundation of small, attainable successes. And, while you're at it, relax; this is optional fun time. Cultivate a laid-back outlook and keep in mind Clough's Principle: "Nothing is worth getting if it isn't cheap enough and easy enough to leave you the resources to enjoy it."

TRAYS VITE exemplifies the principle. It's made from foam hamburger trays. You can't get started cheaper or easier. Most of the shaping needed is already hidden in the raw material. While it won't cost an arm and a leg to trash it if you run out of juice, you stick with it and you'll get encouragingly spectacular results. TRAYS VITE is light, strong and airworthy. Even though it's made mostly from throwaway trays from the deli counter it looks good enough that people will think you paid money for it.

11941

Trays? You can start by pawing through the garbage, or get smart and go right to the source. Most deli managers I've asked would give me a dozen for a buck or maybe just a thank-you.

One thing about deli trays: They were designed for food and have a closed foam to which practically nothing will stick, with one exception: UFO cyanoacrylate glue. I prefer the fairly thick green label variety. Most CA glues dissolve foam like hot coffee on sugar cubes; UFO doesn't melt foam or produce eye-smarting fumes, but it isn't cheap, either. In fact the price has doubled since I started using it. Bite the bullet, you need it. TRAYS VITE still comes out much cheaper than an ARF or a kit.

For tools, get a cheap metal-edged ruler or try-square and a box of disposable "utility" razor blades. Razor blades are better than hobby knives for cutting foam, but dull rapidly. Discard dull blades before they start to tear instead of cut the tray material.

Plastic potato chip bag clips make good clamps. Get the kind with the smooth jaws, not serrated. You'll need pins; I favor the glass-headed type. Use waxed paper over working surfaces. Good ventilation is a must when using any model airplane glue, paint or dope. And *always* wear a dust mask when sanding *anything*.

Foam delicatessen trays are made in many shapes and sizes. You want the smooth ones, not the waffle-grid type. Study the plans with attention to the cross-sections. The fuselage, for example, does not have to be exactly the cross-section shown on the plan, but shoot for similar dimensions and volume. You should be able to find something.

The wing takes advantage of the curved edges of the trays to form the airfoil. An awful lot has been written about airfoils for models. Don't be intimidated by stuff written by experts worried about wringing out that last 10 percent of performance. Any shape that looks reasonably like a wing section will fly OK. What *does* matter is alignment, balance and angles of the flight surfaces—wings, tail and rudder. Concentrate on these and TRAYS VITE will fly.

Wing, motor and wheel positions should come out about the same as shown on the plan. Getting the boom installed straight will save a lot of fiddling with adjustments later on. The original wing was glued up from four pieces. Use fewer or more sections depending on the size of available trays. Just try to keep the area and curvature about the same and be sure to use a CA-glued balsa strip joiner between the panels. Balsa strip joiners are the Big Secret to the successful joining of foam sections. Just wetting the foam with CA and putting the edges together can keep the glue in liquid form almost as well as the bottle it came in. Inserting a strip of 1/32 balsa will result in a quick-setting, rock-stiff joint.

BUILDING TRAYS VITE

Before you cut any trays, look at the plan. To build something we must have starting places for our measurements. These starting places are called datums." The first datum is usually along the centerline of the plan view (what you see looking down on top of the thing). The first datum for TRAYS VITE is therefore the seam between the fuselage halves. This line is extended forward through the engine shaft and back through the tail group. Details shown in the plan view are measured from this reference. (The wingtips, for example, measure from each side of the datum, as does the horizontal tail surface, width of the fuselage and boom, track of landing gear, etc.)

The next datum will be to locate what you see when you look at the side view (side elevation). This line should also be some obvious, logical, fixed feature—the bottom of the fuselage pod, for instance. Heights and spacings shown in the side view are located from this datum. Now we need one more datum to nail down the location of things that refer to the other two datums. This is the reference that shows the distance fore or aft from a fixed point on a line that is common to both the plan view and the side elevation. Where to put it may not be so obvious. It would be usable, even if not convenient, placed just about anywhere from the tip of the tail to the prop spinner. The plans for TRAYS VITE show it as the face of the first bulkhead (the firewall).

Let's start construction with something that's almost impossible to screw up—the tail boom. It's a self-aligning triangular box built against a flat surface.

Bevel the edges of two 1-inch wide pieces to get flats to hold some glue. Pin them to the 1-1/2 inch wide strip previously pinned flat by the ends. When you feel they are aligned as well as you can get them, tack the edges every 2 or 3 inches with a drop of UFO. (Keep the glue away from the pins.) Wait 5 minutes and you'll have a rigid triangular tube even though it's only tacked together in spots. Pull the pins, stand it on end on waxed paper and run several drops of Elmer's or similar white glue down all three inside corners; let it run full length to fill the seams. When dry inside, wipe a little more glue into the seams of the outside corners and put the boom aside.

Study the fuselage pod design before cutting anything. Be forewarned that opposite sides of the same tray may not be quite symmetrical if the tray was pulled out of the mold hot. Better to cut the opposing sides by matching two different trays. Study your trays a moment and compare the actual dimensions you can measure against those shown on the plan. They may be fairly close or vary as much as 1/4-inch. No problem. Find the center point of the long way of the tray and measure back to the firewall bulkhead. (See the 5-3/8 inch dimension on the plan.) If your trays are shorter or longer than those used for the original TRAYS VITE the difference will show up in a shorter or longer "chin" (that front part of the fuselage pod that sticks out ahead of the firewall) and the boom may exit the fuselage either side of the "approx. 11-1/2 inches" dimension shown on the plan. No sweat. The important thing is that the front end of the boom and the main landing gear bulkhead are 8-1/2 inches back from the firewall.

There are no exact plan dimensions for the bulkheads. Cut across a couple of extra trays to make a pattern to trace the cross-section. (Be sure to allow for the filler strip that forms the "keel" of the fuselage.)

Now cut out the sides. Glue a 1/16x3/16 balsa joining strip to the lower edge of one half-shell and hold it flat against a wax paper covered surface until the CA sets. Now you have a straight seam against which to glue the other half.

Note you still have gaps at the front and rear of the fuselage pod. The rear slot will accept the web that braces the tail boom to the fuselage. The front will be filled after installing the nose wheel and filling the chin with scrap foam.

Assemble the 3/32 plywood bulkhead into the fuselage at the 8-1/2 inch dimension. Make sure everything lines up. Make a trial fit of the tail boom to its triangular notch. Don't glue the boom in until after the bulkhead is glued in place and solid. Then install the tail boom and the sheet balsa web that reinforces its juncture with the fuselage notch. Insert the rear landing gear wire through small holes in the fuselage, line it up and tack it in place with small drops of CA. When the glue sets up, fill in around the wire with scraps of 3/32 balsa to provide a surface to which you can glue the 3/32 ply cover.

The front or firewall bulkhead is next. This also holds the nose wheel. It's a lot easier to drill the bulkhead or cut the 1-3/32 inch motor hole on the bench than in the plane—do it now. Sandwich the nose wheel leg to the bulkhead in similar fashion to the way you did the main landing gear. Clamp until solid, then glue it into the nose of the plane. Pack the chin area with scraps of foam. Next put in the balsa cabin floor, resting it on the inside corners of the tray sections between the main bulkhead and the nose bulkhead you've just installed. The windshield and top of the fuselage behind the motor bulkhead are covered with 1/16 sheet balsa. Stick on the windshield area first. Note you can twist the fuselage one way or the other at this time and hold it while the glue hardens to correct small misalignments. Leave off the top cover until after the powerplant is installed.

Install the 3/16-inch wing dowels through holes cut in the foam and balsa boom with a length of sharpened 3/16-inch brass tube. Stick on the 1/16x3/16 wing rests on top on the cabin as shown on the plan.

The wing is easy. The curved edges of the trays are used to shape the airfoil section. Cut the panels from as many trays as needed to fill out the span. Use balsa joiners between adjacent *flat* sections as you build the wing upside down on your wax paper covered building surface. Gaps between the curved leading edge joints are filled in with straight pieces of scrap after the wing is taken up and trimmed flush with a sharp razor blade.

After assembly, true up the rear edge of the wing with a straightedge and razor blade and glue on the balsa trailing edge. True the leading edge in the same fashion, then glue on a length of 3/16 square balsa and round the leading edge by shaving and sanding. Cut completely through the leading edge and the wing's curved surface at the center joint for about 1 inch. Score the rest of the wing center joiner fairly deeply on the bottom side but do not cut through. Score the balsa trailing edge lightly on both sides. Now hold down half of the wing with a fairly heavy book, crack the center section upward along the score and raise the free end of the wing 6 inches above the work surface. Hold it in place with any handy object, making sure the bottom surface of the wing remains parallel to the building surface. Put several drops of CA along the cracked center section and let it harden. Note that this will open up a vee in the front inch or so where the wing was cut all the way through. Fill this gap with scraps of balsa and apply more CA glue.

You now have a pretty fair wing with about 3 inches of dihedral under each tip and hopefully without twist. If by some mischance you did get twist, don't sweat it. The advantage of this type of construction is that you can re-crack and re-glue until it suits you.

Cover the center section with any color you wish of 1-1/2 inch wide *cloth* decorator tape. (Plastic might bubble up under hot sunlight.) The plan shows how to lap it over double on the top and bottom. This strengthens the joint and protects the wing's foam surface from the rubber bands that hold it to the fuselage.

Make up the tail surfaces. These are simple flat cutouts with the edges rounded gently with fine sandpaper—except for the elevator leading edge. Stiffen this with a rounded-off strip of 3/16 square. Control tab hinges are strips of soft aluminum taken from the tear-off lids found on snack food and nut cans. UFO glue them in place. Try for a nice parallel alignment of the tail surfaces with the boom and fuselage sides.

Lo and behold, your plane is mostly built! Time to think about getting airborne.

The original free-flying TRAYS VITE was flown successfully with both the Cox Pee Wee .020 engine and the HiLine Imp electric motor. Either powerplant is a good choice.

Combustion engine power is light, powerful and quickly refueled. It will easily give you the most flights per time frame, but it is fairly messy and somewhat noisy. It requires extra stuff to make it work, like a starting battery, glow plug clip, can of fuel and some way of filling the tank. Until you get the hang of it, wet engines don't always start instantly.

Electric power, on the other hand, is totally clean, always starts instantly and is very quiet. But it's considerably heavier and, unless you have extra batteries, takes much more time to "refuel." Get careless with the wiring and you could melt through your plane, start a fire or explode battery cells. Like a wet engine you still need a separate battery, or an adapter to your automobile battery to recharge the plane. Finally, in a crash, the heavy flight battery is a loose cannon inside your plane.

If you choose the HiLine Imp powerplant, follow HiLine's advice on run-in and fusing, but my advice on mounting. Two or three fat drops of hot melt glue will make it easy to adjust the thrustline angle—simply soften the glue gobs, tilt the motor and let it "freeze" in the new position. For battery mounting, stick a length of sticky-back Velcro to the floor and attach a piece of its mating grabber to the battery pack. Now you can easily move the pack backward or forward to adjust balance. Position the on-off switch in the windshield area.

If you choose the Cox Pee Wee .020 (don't even think about using the Cox .049 in this free flight version), make up a second 3/32 plywood firewall to fit the engine, CA glue it to the existing firewall and redrill the mounting holes. Seal the surface of the plywood with clear water-based latex varnish before mounting the motor. Note that you can use washers between the engine mounting lugs and the firewall to adjust the thrustline. For either powerplant installation select a propeller size according to the manufacturer's advice. My favorites are the flexible black plastic ones from Cox. You can beat them out of shape, but they practically never break.

FLYING

A large deserted field and no wind are ideal conditions for testing.

Before you take the model out, balance it so it hangs level when supported on fingertips one-third of the way back from the wing's leading edge. This is easily adjusted with the electric model, with its moveable battery pack. The gas engine version may require a dab of clay or sliding the wing slightly fore or aft. (My favorite fudge is to use a heavier or lighter nosewheel.)

First glide the model, over tall grass if possible. Aim its nose at an imaginary spot 25-30 feet away and give it a fairly good shove. Bend the control surface tabs until you get the longest glide possible. (This will automatically assure that you aren't diving into the ground or popping the nose up and falling back.)

Before trying it with power, run the engine several times and use a stopwatch to see how long it takes to run out a full tank. You'll find it pretty consistent. You can be fairly confident about burning it down to 10 or 15 seconds before launch. Limit the motor run on the initial flights to 20 seconds or less. It's decidedly unusual, but not impossible, for a model to be perfectly set up as built. Don't risk a flyaway. During 50 years of free flight it's happened to me twice.

If electric, run the battery nearly dead before you toss the model. The battery's major thrust will peter out rapidly, although the motor may run quite a long time just ticking over.

With the Cox Pee Wee, reduce the thrust by installing the propeller flat side forward. Don't try to cut engine thrust by running full rich; it may finish up with a screaming lean-out that can zoom up out of sight or spiral sickeningly into the ground.

During adjustment hops it's 99 percent certain the model will turn one way or the other. That's fine, but the ideal turn is shallow and to the left. Don't try to make it fly in a straight line.

If you've built and balanced close to the plan, your first powered flights will probably result in nosing up and stalling. On purpose. Drawn that way. I promised you a good ride, and this will show you something you need to know. Don't try to correct this condition by monkeying with the elevator if you've already got it adjusted for a good glide. Don't do anything until you try the following experiment.

Tie a string to the prop hub and get a friend to hold TRAYS by the wingtips in flight position. Level the string and pull gently. Now you see it. The nose swings up under power because the pull of the propeller is below the drag of the wing (simulated by your friend's hands holding the wingtips). This rotates the nose upward.

Notice that you can increase the rotation by pulling upward on the string and decrease it by pulling downward. You can find an angle where the pull neither raises nor depresses the nose. Now loosen the powerplant's mounting bolts and tilt the propeller shaft downward to the angle you found with the string that didn't lift the nose. With the Cox .020 version you can slant the thrustline by loosening the mounting screws and sliding in a wood wedge, to be glued in place later when you find the final angle.

With the electric motor, soften the hot melt adhesive with the nose of the glue gun, tilt the motor and let the glue re-harden. Tilting the thrustline downward, "adding downthrust" to align the pull with the drag vector of a model, is one of the oldest and best of the model fliers' tricks. Get comfortable with it. It's part of the savvy you need for setting up both successful free flight and radio control models.

(CAUTION; The operative concept of downthrust is not that it is *down* but that it *reconciles* or *equalizes* off-center forces of thrust and resistance. There are cases, when the propeller is located above the center of drag—usually low-wingers and flying boats—where the situation is reversed and the thrustline must be tilted upward. And some planes, notably mid-wing aerobatic ships, have their thrustline even with the center of resistance and require no offset. Maybe a bit to one side, but that's another story.)

Properly glide-trimmed, and with the proper thrust offset, increases in speed will add altitude and decreases in speed will lose altitude. Never, and I mean *never,* think of the elevator as something that makes the plane go up or down. The real up-and-down (altitude) control is *thrust.* All the elevator controls is *attitude.*

Your plane should fly pretty well after this adjustment, but as you experiment with making it go right or left, you will find that a little rudder goes a long way and as a practical matter you can't move the rudder without moving the elevator too. Less turn means less elevator, but if you want small circles you have to increase the elevator "up" to hold altitude. But there are limits. Beyond a certain point no amount of up elevator will keep the plane from spiral diving into the ground. Why is this?

A great deal has been written on the subject of Spiral Stability. There are even theories that purport to offer rules of design to obtain it. My advice to newcomers is to ignore the whole concept. There's no mystery about it. Planes spiral dive when their controls steer them into spiral dives. Period.

Consider the rudder. Deflected, it pushes against the slipstream and the slipstream pushes back. This swings (yaws) the tail sideways. If nothing else was involved, this would not "steer" the plane, but only make it fly crabbed, or sideways.

But in flight, the involvement of "nothing else" never happens. Something else is always involved. Like wing dihedral, or the simple fact that even a non-dihedral wing crabbed into the relative wind produces more lift on the foremost edge. This imbalance of lift tilts the wing into a banked attitude and the plane starts to turn.

As far as the rudder is concerned, nothing has changed. It is still pushing the tail sideways, but the axis about which it is pushing has been tilted. The side push now angles upward and raises the tail. Tail up means nose down. The plane heads downward and picks up speed. As speed increases, so does the air pressure against the rudder. It pushes harder, lifts the tail higher and the spiral steepens, accelerates and tightens up. Next stop: Trash City.

But that doesn't have to happen.

One of the great things about model airplanes is that they teach the art of compromise, of balancing forces against each other. Pay attention; this can encourage you to believe that for every problem there may be a solution.

For spiral diving, there is a fix. Two fixes, in fact. The first dates all the way back to rubber-power days. You always wanted a rubber job to circle so you wouldn't have so far to chase it, and if it found a thermal it would more likely stay in it until the dethermalizer kicked in. How do you get that? You balance it so tail heavy that it bobbles along in straight flight in a virtual stall, then you bend in rudder until the "down" of the banked rudder cancels most of the nose-up effect of the tailheaviness when it's gliding. Now use the considerable torque effect of the fully wound motor to reconcile this adjustment under power. When the rubber runs down and the prop folds, your model settles into steadily circling flight.

This also works for powered models, but there is something even better to set up a recovery reaction directly proportional to the forces tending to spiral the model: gyroscopic precession.

A spinning body, say a flywheel, has the interesting characteristic that when something disturbs its plane of rotation, it pushes back, not where it was disturbed but 90 degrees further along the direction of rotation. Ever played with a toy gyroscope? If not, it's time you did.

Cut out a 6-inch disk of cardboard and mount it with a thumbtack axle stuck into the eraser end of a pencil. Spin it counterclockwise like a model plane propeller. Now poke at this spinning disk with your finger and watch what it does. When you poke it, nothing happens where you touch it, but a quarter-circle beyond there it *tilts.* Now hold the pencil level so the disk is perpendicular. Imagine the pencil is the propeller shaft. Spin the disk and, holding it at arm's length, swing your arm to the left and to the right. Watch what happens. Did you notice that swinging the spinning disk to the right tilted it *down* and swinging it to the left tilted it *up?* The spinning propeller of your model does the same thing. The difference is that it is rigidly attached to the shaft of its powerplant and tries to tilt the whole plane. In a right turn it pushes the nose down, in a left turn it pushes the nose up. The harder the control surfaces force the turn, the stronger the gyroscopic forces react. The message is direct and simple. If you want to turn tightly without risking a spiral dive, turn to the left. Don't worry about the glide. Set up for a left-hand turn under power and the glide will take care of itself. Go ahead. Play with the idea. Get a feel for it. Experiment with the difference between heavy plastic props and light wood ones. Maybe even add a small flywheel.

Flying is what it's all about. Get out and fly. Tweak your adjustments. Try anything. Remember, even write down, what happened when you did what. Take it from me; if you don't crash now and then, you're missing something.

RADIO CONTROL VERSIONS

It would surprise me greatly if, while you've been mastering adjusting a free-flying TRAYS VITE, you haven't been wondering about the possibilities of radio control. It's the logical next step. It has to be. Small electric and wet engine jobs of .020 size or less, compressed air, CO_2 and rubber-powered models are the most massive free-flying aircraft anybody should turn loose near populated areas. For anything bigger, the name of the game is *responsible operation.* That means Radio Control.

Radio Control, keeping an electronic leash on your airborne critter, gets you right up there with it. You not only get greater safety and the satisfaction of steering it around the sky, you also save a lot of chasing over hill and dale after flyaways. Oh, it's still possible to lose one now and then, but you'll have machinery to blame instead of bad luck or your own lousy judgment. Finally, radio control can put you in touch with interesting, knowledgeable and generally helpful people with whom to share your enthusiasm for model planes.

You can control TRAYS VITE for minimum bucks by installing a Cox FailSafe unit. With an already proven free flight on hand, the conversion to rudder-only is fairly simple. It's a tight squeeze widthwise, but all you'll need is a couple of gobs of Goop household cement or hot-melt glue to hold it in place. Cut a small hole in the fuselage to get at the switch, snake the antenna wire down through the boom and let it dangle. Remove the right-hand rudder, armor it with a holed U-shaped clip of tin can metal to receive the control cable end, and remount it with a couple of Du-Bro hinges. Leave the other rudder as is for a trimmer.

How the control works should be clear from the sketches. Use Sullivan #507 Goldenrod cable, which comes with its own neat little fittings. You'll need one of the threaded ends to make your adjustable rudder connection. The threaded connector is soldered to the end of the cable and goes through the hole in the rudder armor where its throw is adjusted between the two 2-56 nuts. CA glue the cable sheath to the underside of the stabilizer, poke it through a hole in the boom, lead it through the boom and glue it close to the servo arm. (Both ends of the cable's guide sheath must be anchored to work properly.)

With either a Cox .020 or HiLine Imp version you'll need a separate four-cell 80-110 mAH battery to run the Cox FailSafe receiver. For the Imp you'll need an additional motor battery because the FailSafe motor relay circuit won't handle the Imp's 20-odd watts. The Imp will run well on three or four 110-270 mAH cells. Use the batteries as moveable ballast to trim flight balance.

The FailSafe radio reduces overcontrolling, the major cause of beginners' crashes, by limiting the length of time you can deflect the rudder. Even if you freeze on the controls, it goes back to neutral after 1 second. That's the theory, but you'll find "neutral" is wherever the trimmer knob has been set. In fact, a well-rigged model can be steered just by turning the trimmer. The trimmer, however, does not automatically return to neutral.

Once you've learned to fly with the FailSafe as it comes out of the box, you may want to follow the Cox instructions and bypass the 1-second timing capacitor. This allows you to hold right or left rudder for as long as you wish. This is useful for maneuvers like snap rolls, spiral dives and quick recovery from either.

Sooner or later, with a little RC time under your belt, you'll want more. It's time to move up to the .049 powered, two-channel TRAYS VITE.

(Before you decide to tear into and modify your already successful free flight/rudder-only TRAYS VITE, consider that TRAYS is such a simple machine that you might find it almost as easy to build another.)

The main difference is a more rugged wing and a different set of tailfeathers. Everything else is the same, but it's a good idea to beef up the front part of the fuselage by lining it with l/32 sheet balsa set in CA. The rakish single-ruddered vertical tail is double thick (stick two pieces of tray foam together with a water-based contact cement). The new, single surface horizontal tail is reinforced with balsa.

I consider Du-Bro #117 hinges just about the best for small models, but be very careful gluing them in place. CA glue can freeze them solid. The safest way I've found is to fit them dry into slits in the surfaces, then make a small hole in the foam to seep down a tiny drop of CA—it takes very little to hold them in place. Control horns cut from tin can metal will work as well as any on this lightweight model.

The thicker, stronger wing needed for .049 power is easy to throw together—but it has to be thrown together in the right order.

Work on a waxed paper covered surface. Both top and bottom surfaces of the wing are glued up from flat tray sections. Don't use the side curves of the trays. Always use a strip of balsa between the edges of mating panels. Put tray mold numbers and trademarks inside. As with the original single-surface wing, you can use more or fewer pieces than shown.

Take the glued-up, now one-piece bottom surface of the wing and trim one edge straight. Note that all spars are centered between the ends of the longer bottom cover. (Tips will be filled in later.) Glue on the balsa leading edge piece and the main spar. Glue a strip of 3/32x1/4 behind the leading edge to form a gluing shelf for the top cover. Make a half-thickness vee score across the middle of the leading edge, wing panel, main spar and the as yet unattached balsa trailing edge piece, but *do not* glue it in place yet.

Give each assembly time to set up rigidly.

The angle cuts of the leading edge and spar allow the wing dihedral to be bent in. Do so now, clamping the liberally glued main spar joiners in place. You now have the bottom surface of the wing assembled, complete with dihedral.

Rest one side of the wing on a flat surface and prop up under the dihedral of the other side to hold it steady. The upper wing surface is assembled the same way as you did the bottom, but as two separate panels. Take one of the upper panels and glue it to the shelf on the back side of the leading edge. Use pins to hold it in place until it sets. *Do not try to bend the top cover before the glue sets solid.*

When the CA has hardened, run a bead along the top side of the bottom cover's trailing edge and bend the top cover down over the spar to generate the airfoil curvature. (It isn't necessary to bevel the underside of the top cover.) Weight the assembly down until everything is solid. When it is, tip the wing the other way and do that topside as well. You must insert the airfoil-shaped filler blocks in the center section before fitting the second top panel in place. Bevel the end of this panel to fit the unbeveled end of the panel already in place to make a neat fit at the center section.

A great advantage of this type of construction is that you get a chance to work out any warps in the separate panels as you glue and pin them down to your flat working surface.

With a good straightedge and razor blade, trim the back edges of the now assembled upper and lower wing panels even and glue on the balsa trailing edge. Get it on straight and true.

Fill in the wingtips beyond the ends of the spars with layered tray foam, get out the 180-grit sandpaper and bring the tips and the leading edge to final shape.

Reinforce the center section with cloth decorator tape, same as the free flight wing. Wing joints can be concealed with narrow strips of tape if desired. No paint is necessary because tray foam is alcohol fuelproof. (Gasoline or diesel fuel, on the other hand, will instantly destroy it.) While we think of it, fuelproof dope the balsa tail boom.

What about the choice of radio for the two-channel TRAYS VITE? I've flown the originals with several different arrangements of transmitters and receivers. The Futaba two- or four-channel receivers with S133 micro servos are a good choice. *Any two-stick transmitter which has the rudder on the right stick and the elevator on the left is a very bad choice.* The kindest advice I can give any beginner in RC is to not even think about learning to fly on this type. Spring for a four-channel transmitter and thank me the rest of your days.

TRAYS flies great with any Cox .049. It has non-steering trike gear for ease of beginner takeoff runs and is easily rebuildable if you crash it—which could happen despite all the terrific advice I'll give you later on.

Mount the servos on cross-pieces and connect them to the control surfaces with pushrods made of 1/8-inch hardwood dowels with paper clip ends lashed in place. The wire ends allow easy bending adjustments after test flights.

Now that you've been through free flight for adjusting and with FailSafe for the feel for steering a plane in the air from the ground, you're in pretty good shape to move up. If possible, have TRAYS VITE test flown by an experienced pilot who can check the trim and balance. If you've screwed something up, an old salt has a much better chance to get it back down in one piece.

Here's your moment of truth. If the plane has already been checked out, it isn't going to do anything violently surprising. At the worst, nothing is going to happen that can't be repaired for a few bucks.

Take it in stages. When you signal your helper to release the model, concentrate on making the smallest rudder stick motions possible to keep rolling straight. This should be easy with the locked tricycle gear. TRAYS VITE will take off all by itself as speed builds air pressure between the wing and the ground. When daylight shows under the wheels, adjust the elevator trimmer for a shallow climb. If the model is turning gently, leave it alone, but if the turn seems to be steepening up, flatten it out with rudder trim. Now play a little game. Try not to touch the sticks and control the circling climb up to a couple hundred feet using the smallest trim motions possible.

If you get this far, you're doing real well. You've avoided the classic beginners' takeoff (a nose-high stagger followed by a snap roll into the ground). Once you have some altitude and your plane is flying practically by itself on trim, you can touch the sticks. Try gentle bumps against the rudder stick and see what happens. Now *gently* bump the elevator stick. "Bumping" may make the flight look bouncy at first, but it won't get you into as much trouble as grasping and hauling. The moves will smooth out with time and practice.

While you are bumping, concentrate on keeping a picture of the plane itself in your mind at all times. Don't be too concerned about attitude or whether the plane is going away or headed at you. Regardless of its position or heading, pulling the elevator stick makes the plane's nose try to rotate *away* from its wheels. Pushing the elevator stick makes the plane's nose rotate *toward* its wheels. The relative position of the plane to the horizon or anything else is totally irrelevant. (Remember this and you'll have little chance of accidentally diving into the ground when you get around to flying planes that go inverted.)

Rudder is different. Going away, right rudder rotates the wing silhouette clockwise; coming toward you, the same command rotates the wing counterclockwise. Finding out which is which at a distance is no problem. Make a quick bump of the stick to the right; if the plane rotates clockwise, it 's coming toward you.

While you're learning it may help to keep a little litany going. Say to yourself as you make each move; "model's left," "model's right," "model's nose up," "model's nose down."

Confine your first flight activity to keeping the plane in a 200-300 foot circle at an altitude of 200 feet or so. When the engine quits, hold TRAYS as level as you can. The nose will drop in the glide. Pull it up with the elevator trimmer but don't overdo it and stall. Trim the rudder for straight ahead, then concentrate on gliding slowly in a wide circle to wherever TRAYS wants to land. When down to within 6 feet of the ground, see how much up elevator you can crank in and not balloon upward. Try to run out of flying speed, altitude and rudder deflection all at the same time.

When you land, leave the transmitter on. Before you pick up the model, shut off the receiver to freeze the trimmed-in control positions.

Now take a good look at the elevator and rudder positions. They won't be quite the same as when you took off because you trimmed them in the air. Try to memorize these positions. Turn the receiver back on and neutralize the transmitter's trimmers. Now bend the control rods' wire ends to return the surfaces to the trimmed positions they were in when the model landed.

Never bend the elevator down to correct nosing up under power if the model glides OK with power off. Remember your free flight experience with downthrust. Install thin washers under the top engine mounting screws to tip the thrustline downward a couple of degrees. Fine-tune subsequent flights if needed.

I like to adjust the rudder for a gentle hands-off nose-down turn. In the rare event of a radio failure, the plane will then spiral down instead of bee-lining over the hills and far away.

Are you having fun yet?

If you are, great. Stay happy. There's so much more territory to explore. Like ailerons, throttle control, retracting landing gear, aerobatics, pattern flying, scale models that look just like the real thing at a distance, and helicopters and jets . . . . ***MB***