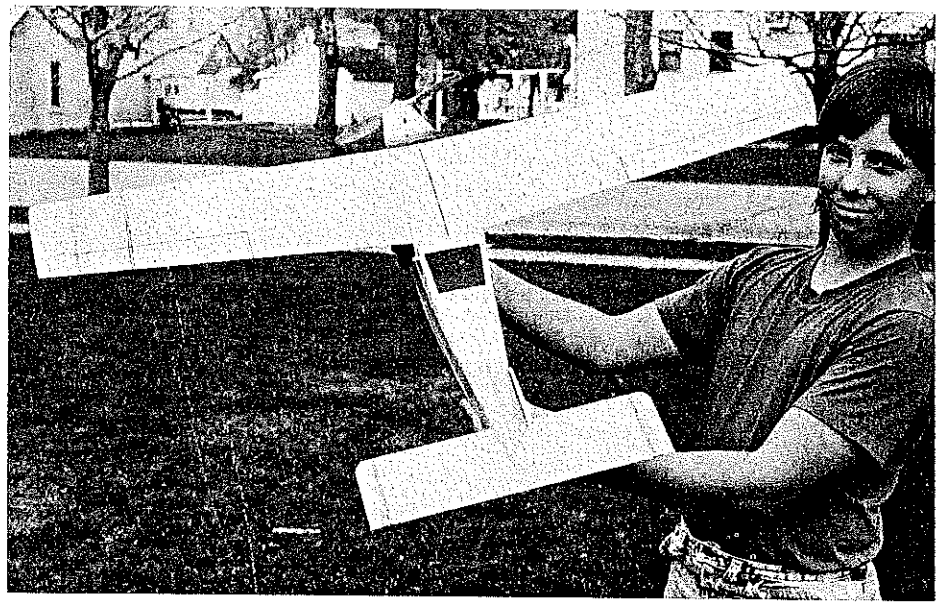
621

Cessna Cardinal

Here's an everyday, rugged FF plane that can be built in a jiffy and won't cost you much. Though no floater, this .049-powered, 39½-in.-span semiscale ship does everything a fun flier should.

■Allen Wulf



Young Danny Evtcheson displays the completed Cessna Cardinal's great moments. Its generous wing area and good-sized stabilizer make the plane a stable and consistent flier. Since this ship is intended more for pure fun flying than duration, keeping the weight down wasn't a major design concern. The model is designed to be simple and rugged. The wings are rubberbanded to the fuselage so that they give during a hard landing. The airplane looks similar to an RC ship but has the low cost and simplicity of Free Flight. The superclean lines of the strutless and retractable-gear Cardinal are nicely echoed in this fun-flying model.

THERE ARE flying days, and then there are *flying* days. We've all known summer days that seem to call us sirenlike to the field. At times like that, when a close look at the model inventory turns up an abundance of high-performance aircraft that you don't want to risk before the big upcoming meets, what do you do?

If you're fortunate, you grab that tough, competent, easy-to-fly sport plane and go fly. But maybe you don't own a fun-flying sport model.

Once, such designs were plentiful. I remember checking one book out of the library over and over again as a kid. It was packed with pictures of neat, realistic-looking models, planes that were designed purely to fly. All had the look of the real thing, with authentic details like cockpits, windows, and the like. And did they *fly*!

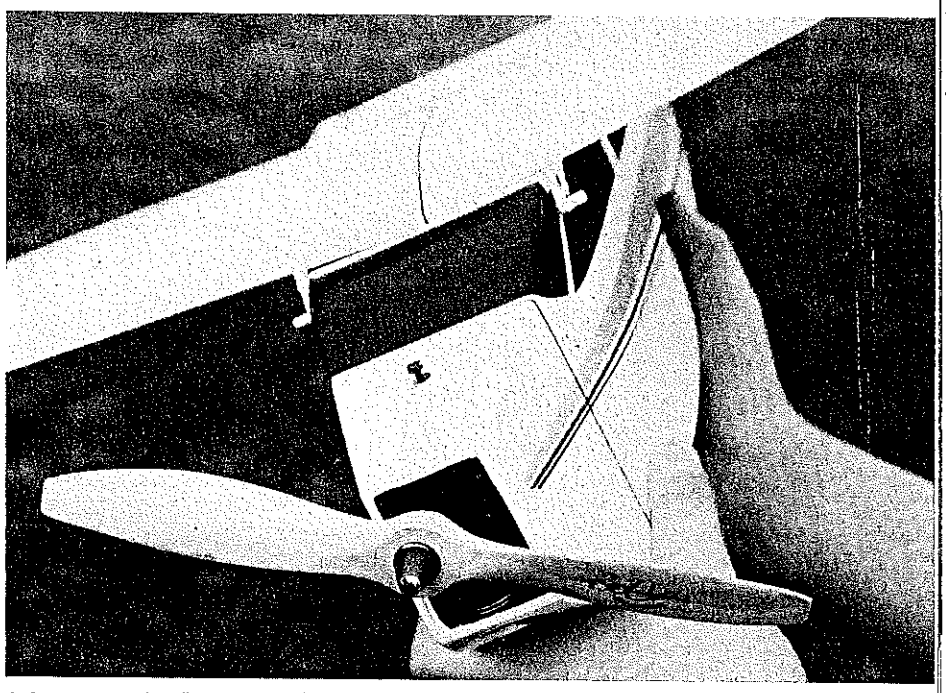
That's what a guy needs to do, I told myself. Build one of those ships and keep it around especially for days like last Saturday. But alas, the books are no longer found on the library shelf. That means one thing: Get busy!

Perusing my stacks of aviation magazines for ideas, I found that the Cessna Cardinal turned up repeatedly. A clean design with no struts, no fixed landing gear, and good moments, it had terrific, rakish lines that would take to balsa splendidly. I knew it had all the makings of a great sport flier.

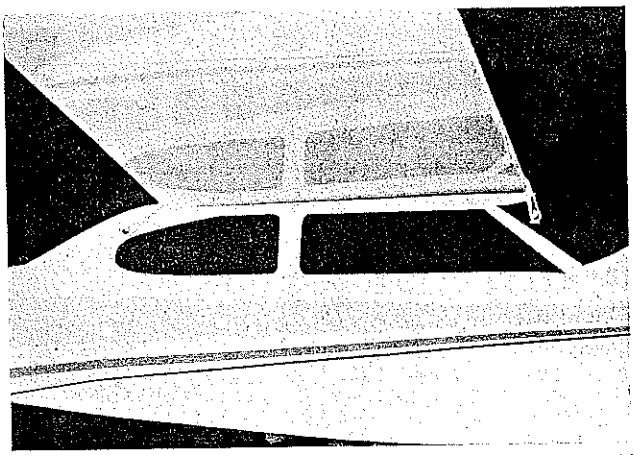
After a trip to the hobby shop where I purchased all the materials for under 10 dollars (except the engine), the Cardinal was built in a day. Obviously, that's quick work, and it was fun as well. No fretting over grams or delicate parts with this model; just build it quickly and make it strong.

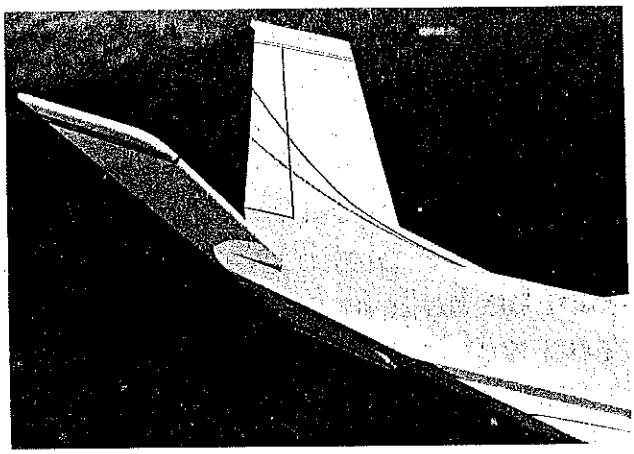
Since no dethermalizer was planned and duration wasn't a big issue, I wanted a model that would fly well but wouldn't be a floater. I wanted a model that I could fuel up, start, toss, and then stand back and watch. With the Cardinal I get to do just that—over and over again.

Sound like fun? You bet! Take your time studying the plans before you begin building. Note that you'll need 4-in. balsa for the fuselage as well as the stabilizer. To keep the building fun and easy, I bought the wide

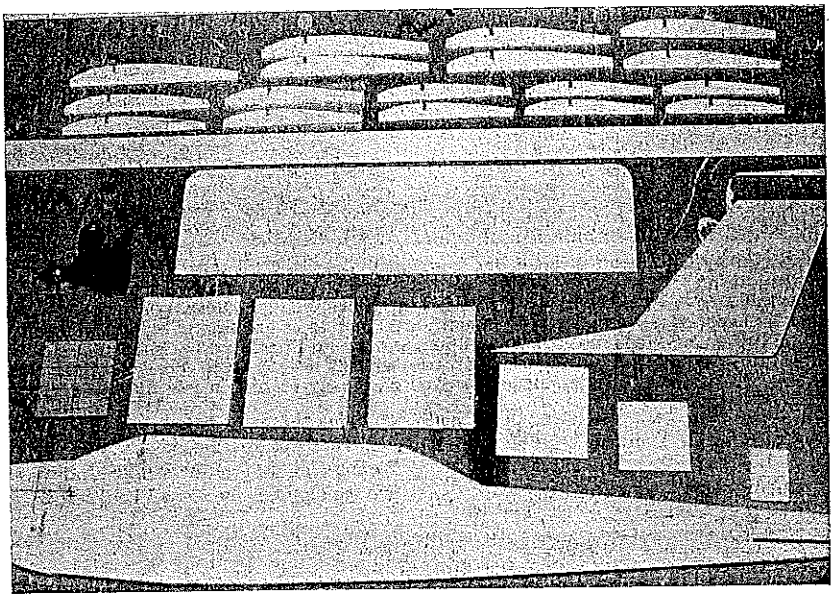


A Cox .049 engine fits neatly inside the nose section and has power to spare. The new Cox Texaco and old Golden Bee engines are ideal. The Black Widow, however, is too powerful. A large prop helps to soak up the excess power and makes the flight path a bit more predictable.

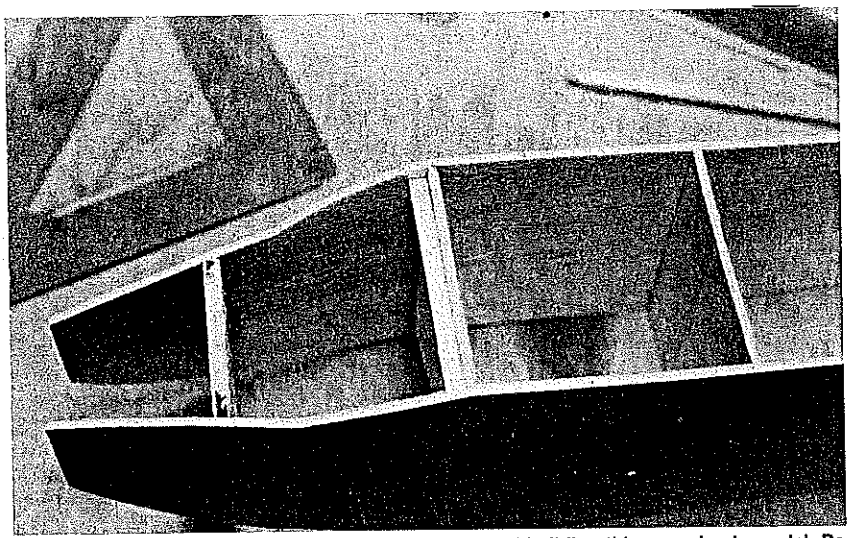




Left: Plastic heat-shrink covering makes the Cardinal shine like the big one. Again, since weight is not a factor and eye appeal is, bright colors and trim tape can really dress up the Cessna. The fuselage cavity under the wing has more than enough room for RC gear, should the mood strike to convert the model. Right: This photo shows the stabilizer mounted in a wedge-shaped slot, an old Free Flight trick, so that the leading edge can be shimmed up or down to trim the power flight phase. Once proper trim is established, a drop of CyA will set it permanently.



Shown here are almost all the parts necessary to complete the Cardinal. Making a semikit before assembly greatly reduces your building time. The author's prototype was built overnight.



Aligning the fuselage box is the only challenging part of building this very simple model. Be sure the fuselage sides are cut to proper shape and that the former locations are correctly marked. Use a drafting triangle to check for square alignment before gluing the parts in place. Fit the triangular engine mount reinforcements carefully in order to fully support the firewall.

wood rather than joining matched 3-in. sheets. Select medium- to lightweight wood. Even more important is its flatness; the rudder and stabilizer must be flat and warp resistant.

Construction. Cutting out all parts in advance, rather than making them individually as you go along, expedites the building process. Using a good CyA (cyanoacrylate glue) speeds things along, too.

Once the parts are cut out, begin by gluing the tip caps on the rudder, stabilizer, and fuselage fronts. Give the tail a good sanding, then round the leading and trailing edges well and set them aside on a flat surface.

Fuselage. Pin the sides together, mark the locations of the formers, and cut the stabilizer slot. The stabilizer slot has a wedge shape with about $\frac{3}{32}$ up-and-down shim room at the front, tapering back so that the stab fits snugly at the rear. This will allow the stabilizer to be shimmed for power flight.

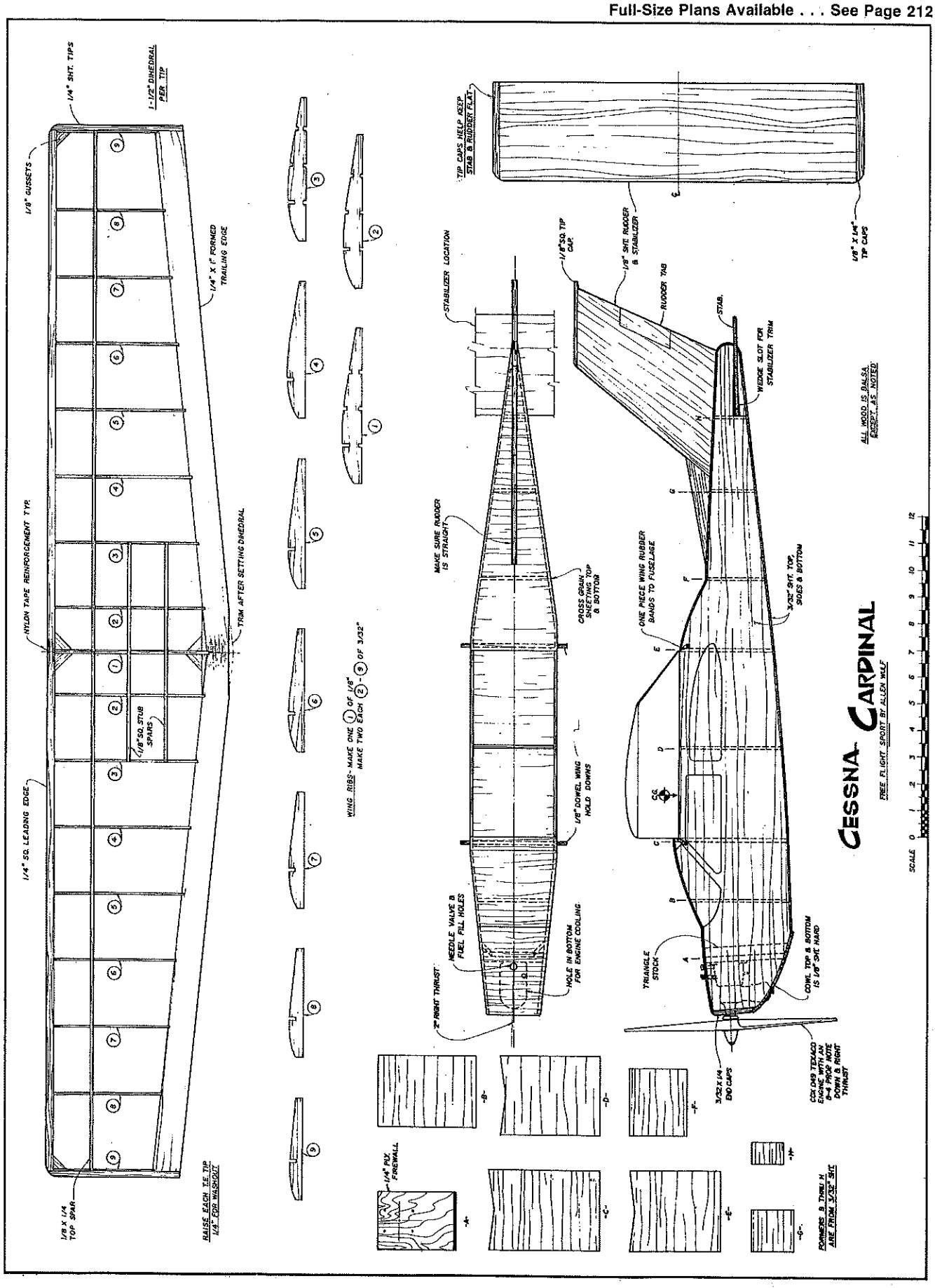
Unpin the fuselage sides, and begin joining them with formers C, D, and E. Pin them in place before gluing, then check for proper alignment. Set the pinned assembly over the plan top view to make sure everything is positioned correctly. Glue in the formers.

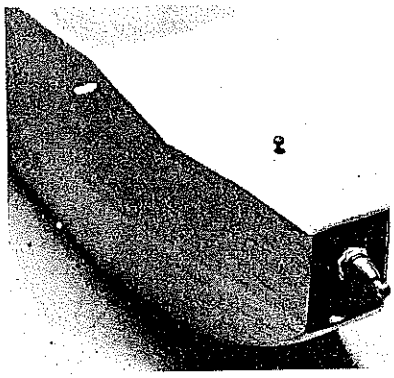
Pull the tail halves together, and check for alignment. If they fit properly, glue them together. If not, make the necessary adjustments before gluing. Fuselage alignment is crucial, since it keys the model from engine to rudder. Any offset or twist makes the aircraft prone to erratic flight patterns.

Glue in formers E through H. Drill the firewall for the engine mount screws at this point; it's difficult to do after the firewall is glued into the fuselage. Sand a slight bevel into the engine mount sides to match the tapered-in fuselage nose angle. Check your work against the plan top view.

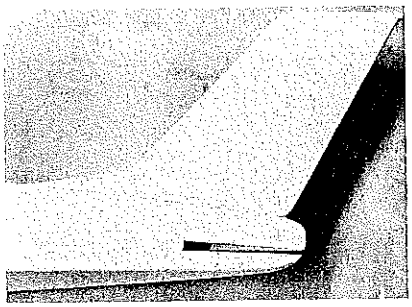
Be sure to angle the firewall for the needed downthrust. The right thrust can either be built in, or achieved by installing

Full-Size Plans Available . . . See Page 212





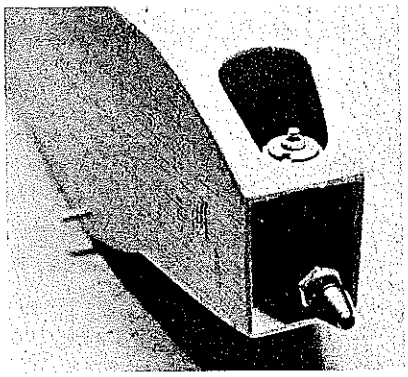
The cowlless nose. The opening is just large enough to pop the engine through and still look good. Note the needle valve in its opening. No extension is necessary. Holes must also be provided for fueling the engine.



This close-up of the rear end shows the vertical fin attached to the fuselage. Make certain there's no built-in tilt in the stabilizer slot before gluing the stab in place. Any stabilizer tilt will cause the model to turn toward the high side when in its glide mode. Induced tilt to control the glide turn will not affect the power phase of the flight.

small thrust washers behind the engine. Once the firewall-to-fuselage joint appears satisfactory, glue it in place with a slow-drying wood glue. Fit the triangle braces along with former B.

Drill the holes for the wing hold-down dowels, and glue the dowels in place. Begin planking the top and bottom of the fuselage, being sure to lay the sheeting cross-grained. This is a lot easier than it looks and goes

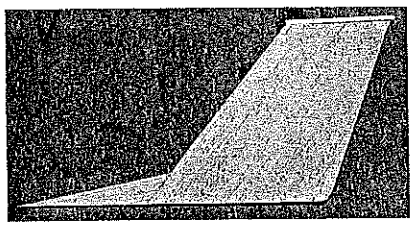


This bottom view of the nose shows the opening for cooling air and glow plug hook-up. Vertical end caps shown on the plan help to make the nose section a bit more rugged. The ⅛-in. bottom sheeting takes the brunt of landing impact since there is no landing gear. Choose the hardest sheeting available that will still bend to the fuselage curve.

very quickly with CyA glues. Start at the nose with the ⅛-in. sheet, the thickness necessary to reinforce the engine area against vibration stress and landing loads. Sheet the rest of the fuselage with 3/32 balsa, except for the area under the wing. This allows the dihedral angle of the wing to nest neatly. Trim off the excess top and bottom sheeting, and sand the corners to an attractive radius. Sure, the full-size Cardinal had more curves, but this is a sport model. Keep telling yourself that!

Wing. Begin by marking the trailing edge for the rib locations. Using a razor saw, cut the notches carefully so that the ribs fit snugly. Pin the leading edge to the plan, then pin the ribs in place. Add the trailing edge and the tips. Fit the main top spar, and make a glue pass over all the joints except at the center rib area.

With one wing panel flat on the board, block up the other half 3 in. Sand in and then glue the dihedral angle. Glue in the trailing edge wedges and the center rib. Glue on the top short spars. After the glue is well set, unpin the wing and glue in the



Close attention to the direction of the wood grain is important in building this model. The correct grain direction is shown in this photo of the vertical fin assembly. Note the tip cap glued to the top of the fin. This important little piece of wood keeps the fin from warping when it's covered or painted. Warping is a prime concern on Free Flight models.

lower short spars. Nylon reinforcing tape or glass cloth may be wrapped around the leading and trailing edges to strengthen the joints.

Sand the wing thoroughly. Carve the leading edge to shape, and sand it well. Round the bottom front slightly. The tips should be squared off, yet slightly rounded.

Covering. I highly recommend the plastic heat-shrink coverings for this type of model. They're fast and rugged, and give a realistic finish without a lot of fuss. I glued the rudder to the fuselage before covering to make sure I had a strong joint, then covered the entire model in white. The trim is yellow, with black and red trim tape.

Covering with plastic also allows you to set the wing warps where you want them. After the wing is trimmed, pin it down to your *flat* building board one panel at a time. Cut a 2-in.-long strip of ¼-in.-sq. balsa for a washout spacer. Lift up the trailing edge tip, and slip the spacer under the last inch of the wing tip. Then pin down the tip in its new location. The covering should be wrinkled at this twist, but running your heat gun or iron over the surface will shrink out the wrinkles.

Allow the wing panel to cool completely before unpinning it. The cooled wing should retain the set-in twist. Shrink any wrinkles

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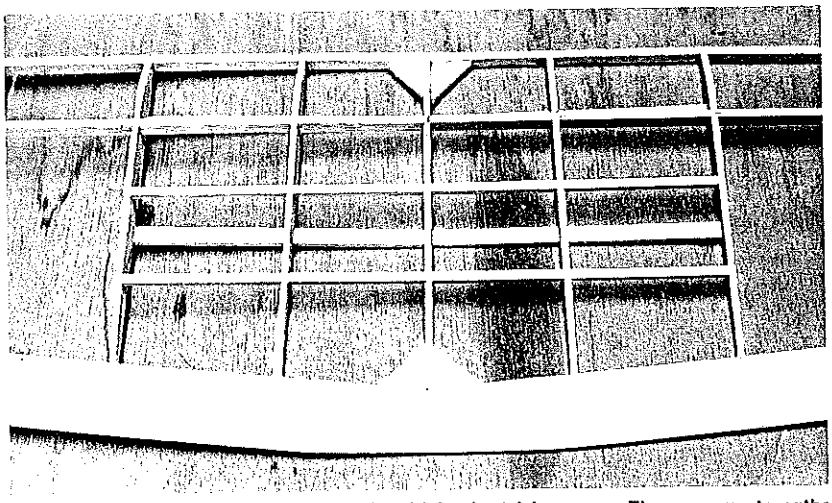
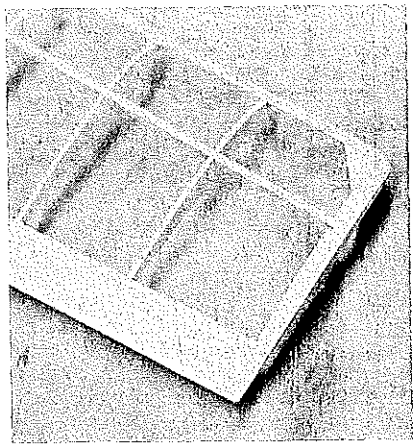


The center wing section is the home of multiple short false spars. These spars strengthen the wing halves, keeping them from separating under power and in a crash. They also help to keep the rubberbands used to secure the wing from crushing the fragile covering.



Wing tips take a lot of abuse, more from hangar bumps than in flight though. The leading edge gussets help strengthen the tips. They also help to keep the covering from pulling in the tip rib and causing surface wrinkles.

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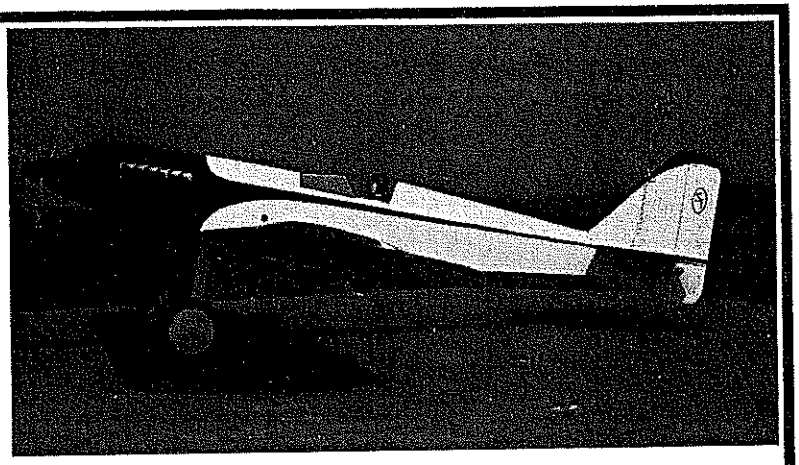

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Revisiting those days of wonder and change has been a happy experience. Many memories, perhaps even dreams, have lit my way.

Cessna Cardinal/Wulf

Continued from page 82

that show up on the bottom, and check the panel again. Repeat the process until the wing holds the desired ¼ in. of washout.

Follow the same procedure to build washout into the other tip. The washout will keep the Cessna from spinning in as it turns.

Mounting the engine and final assembly. Cut the openings for the cylinder, fuel fillers, and needle valve. Fuelproof the engine area with a thin coat of epoxy or several of dope. Mount the engine, and check for the proper thrust angles when viewed from the top and side. Select an 8 x 4 wood propeller, and make a bushing for the center hole so that it fits properly on the engine shaft.

Slip the stabilizer into its slot, wedging the leading edge snugly from the top and bottom into a neutral position. Glue the trailing edge, and pin it securely. Attach the wing with rubberbands, centering it on the fuselage, then mark the centerline on the wing and fuselage so that you'll mount the wing at the right place each time. Small dowel wing keys may be added to the bottom to ensure alignment.

Trimming and flying. Check the balance point, adding weight to either end until it agrees with that shown on the plan.

A few words on trimming Free Flight models are in order. As a high-wing cabin model, the Cessna is more stable if flown in a right-power, right-glide program. Trim for power and glide phases separately. The powered phase is broken into two basic directions: climb and turn.

Climb is achieved in two ways: by thrust and by incidence. Downthrust compensates for the wing's lift. If the model zooms and hangs on the prop, more downthrust is needed. If it arcs into the ground, less is needed. If the airplane wants to loop under power, it needs less negative incidence in the stabilizer, which is accomplished by shimming up the leading edge. For a faster climb, add shims to the top of the stabilizer leading edge to increase the negative incidence.

Power turn is trimmed by engine thrust and rudder tab. Thrust plays the major role in compensating for torque. In reaction to the propeller turning to the right, the model will want to turn left. We want to counterbalance that natural tendency to turn left by making the airplane turn right. The right thrust shown on the plan will be sufficient for most engines; however, the hotter the engine, the more right thrust you'll need.

Adjust the rudder trim slowly, since a little bit goes a long way. A rudder trim tab is shown on the plan. Slice the rudder at the top and bottom of the tab, and simply score the hinge line of the tab. A slight pressure should be all it takes to move the tab where you want it, and a drop of CyA will set it. Aim for a power turn of about 100 ft. in diameter, with a gentle climb of approximately 10 ft. per turn.

Adjust the glide independently, so that it won't interfere with the power trim. Test glide the model over soft grass. If it stalls, add nose weight to settle the nose. If it dives, remove nose weight or add tail weight until an acceptable glide is achieved. Glide turn is accomplished by tilting the stabilizer when viewed from the front or rear of the plane, which will then turn in the direction of the high stabilizer tip. To glide right circles, we want to promote a gentle turn by raising the right tip about ¼ in. or less. The washin we put into the wing tips attempts to keep the wings level, with one wing tip balancing out the other. Stabilizer tilt works by upsetting the balance enough to allow the

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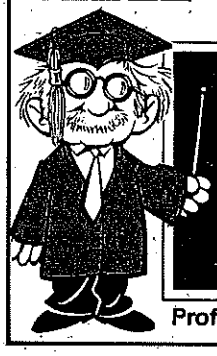

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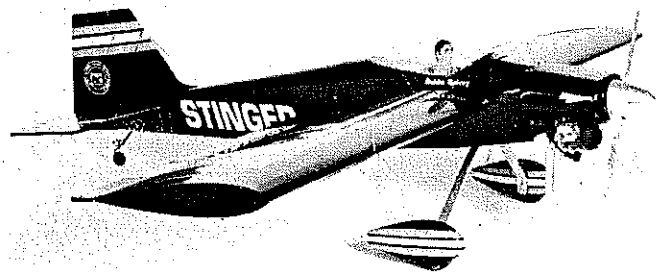

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turn.

I use a small medical syringe to meter the fuel into the engine. The Cardinal will fly out of sight on a full tank, so measuring your fuel is important. Limit your first test flights to short engine runs of one to five seconds, stretching them to as long as is practical (i.e., as long as you care to run after your model) once things look safe.

Normally I start by priming the engine and hooking up the battery. Once the prime and any fuel left in the tank run out, I feed in a measured amount, check the wind direction, and start the engine. The needle valve is preset to produce a slow, even run; so once it's running, it's time to launch!

If it's a gusty day, the Cardinal is probably ready for it. With its trim and dihedral this model will handle a fair amount of wind. Make sure she's launched directly into the wind, or just slightly off to the right.

Sport flying should *always* be this much fun!

Krackerjac/Winter-Evans

Continued from page 90

is used to begin the roll, followed by a smooth and steady advancing of the throttle, the pilot won't need to hold *up* for takeoff at all. By allowing roll to develop a bit before going to higher power, you increase airspeed to the point that the rudder has good bite for steering. With a tail-dragger, steering control at low speeds derives from the tail wheel much more than from the rudder. If a quick surge of power is allowed to lift the tail instantly, the airplane will lose steering power due to loss of tail wheel traction.

In a 5-mph headwind, MK I will climb quickly to landing pattern height at even one-third power. On more power, expect the airplane to climb rapidly and fly on the wing.

The two degrees of dihedral permits free flight hands-off stability, yielding continuous turns on either aileron or rudder without compromising wingovers, etc. When "stooging around," wide turns can be tightened as much as desired by a touch of *up* elevator. The nose won't drop, and when you return to neutral and roll out the plane will be nose-up.

To invert MK I, raise the nose slightly (say, 10°), and then do a half roll. This allows you time to feel for matching *down* elevator before the nose drops. Powered by the .40 engine, the model will sustain inverted maneuvers—including steering, figure eights, etc.—at two-thirds power, one-half going down (or no more than two-thirds going down in any circumstances).

Three or more consecutive, concentric outside loops can be done, flying off the top at half power and one-third to one-half going down. More power and speed opens up the outside, increasing loadings on the upside and possibly causing twisting out. This ship has area that's intended to be used.

Landing approaches are long, and the air-