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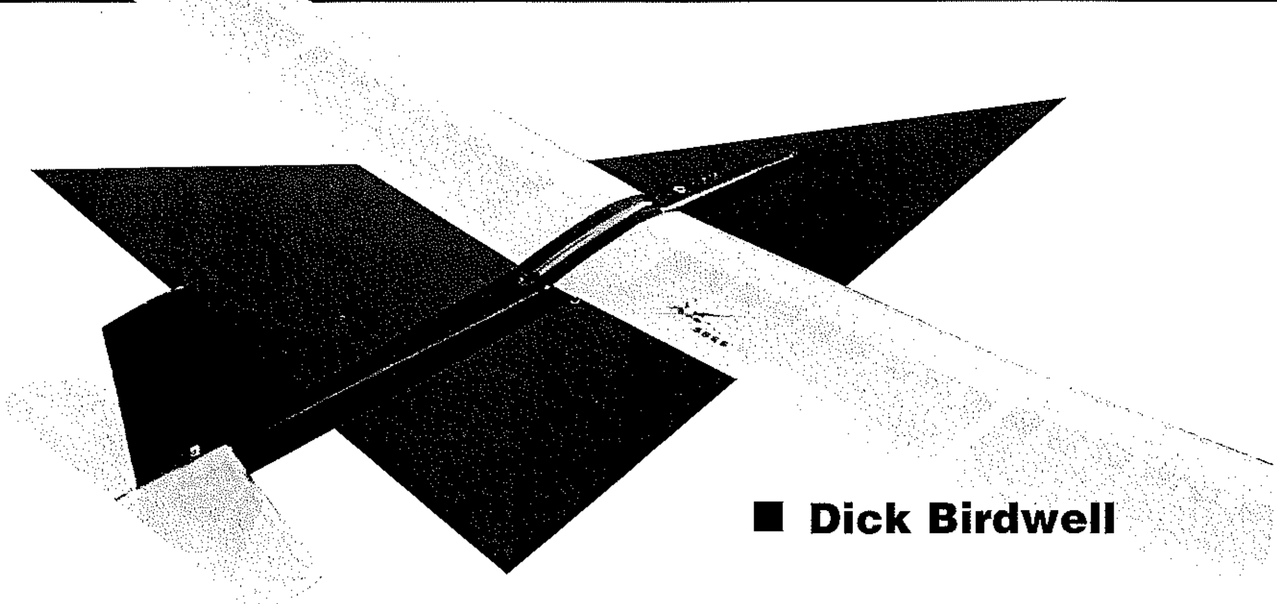
RC

This multipurpose Two-Meter sailplane can help you "step up"

STRIDER



■ Dick Birdwell

In late 1995, after a bunch of fiberglass-and-foam-wing hand-launch gliders, I needed a change of pace—more flight time with less work.

A Two-Meter sailplane with a two- or three-piece wing (to fit behind the seat of my pickup) is the right size; built-up structure with two or three controls, to keep the cost down; a durable structure that will withstand a winch zoom launch; excellent soaring capabilities; and suitable for a begininer as a trainer that would survive the learning experience.

With the purpose of the glider defined, let's look at the most important part of the glider: the wing, its airfoil, and planform.

The foundation of performance is the airfoil. Richard Eppler's E-205 was selected because of its wide range of performance; gentle stall; it's thick enough for good spar depth; enough of the bottom is flat to make it easy to build and cover; and most of all, its long-proven history.

What is the planform, or the optimum wing area within the confine of a 79-inch wingspan? From a previous glider I designed for the strength I wanted, the minimum weight was going to be about 6 oz./sq. ft. of wing area. Using airfoil data, preliminary calculations indicated the wing area should be four square feet for the weight. To verify the wing area it was recalculated at increasing weight increments. As the airspeed increased (because of higher wing loading) the performance improved because of increased airfoil efficiency. Let's turn this into a dual advantage: Why not two wings—a light one that will have low flight speed for a trainer, and a cleaned-up, heavier wing for sport and contest flying?

The Mk I (light wing) is a slow-flying, very forgiving, extremely durable glider that will survive the learning curve.

With the Mk II (high-performance wing) the Strider really starts to shine. It will fly almost as slowly as the Mk I, but with a bit of down trim it really moves out. In fact, the only glider that was able to beat its performance was the old Prodigy. Even the Mk I will outperform any currently kitted built-up 2M glider.

CONSTRUCTION

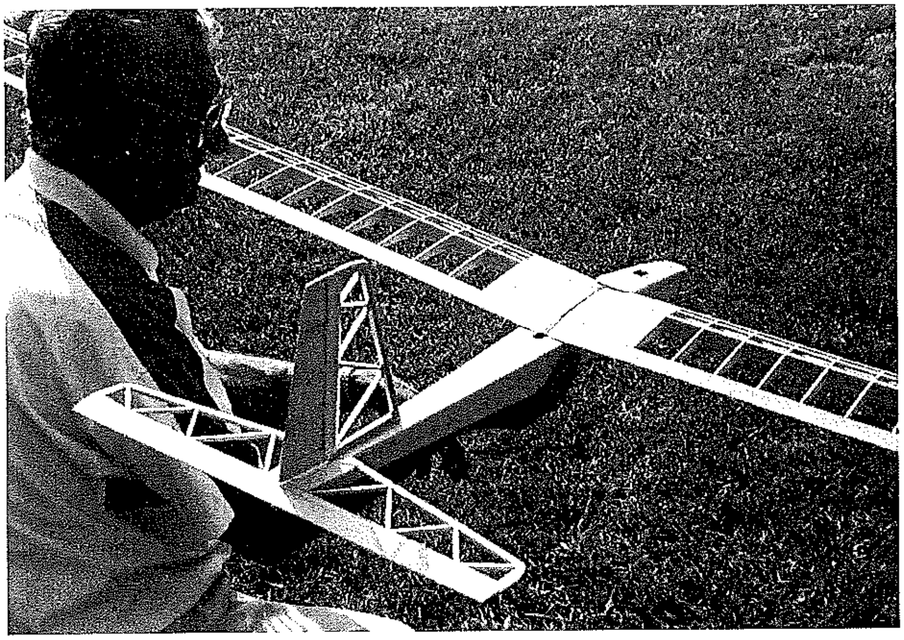
A word about cost and building: The cost of the plan and materials will be about the same as a good kit. You'll find that the Strider is very easy to build, but it will take longer to build than a kit, because you will have to cut out all the parts. The "up" side is that you'll have a stronger and better-performing glider than any made from a current kit.

Use the weights of wood called out on the plan. Lighter is *not* better—it's just *weaker*. Use only the radio flight pack component sizes called out on the plan. The flying weight of the Strider with the Mk I wing should be about 24-25 ounces; with the Mk II wing, about 31 ounces.

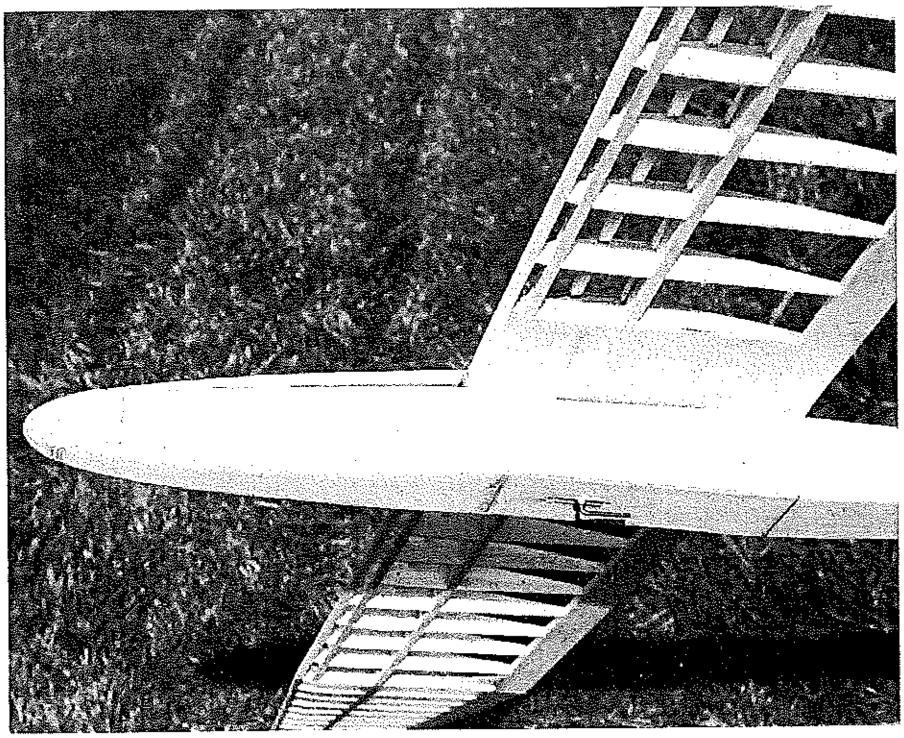
Empennage: A fancy name for a start to build the horizontal and vertical stabilizer. Use a razor saw for all of the cutting of the wood and use care to make good joints. Use gap-filling cyanoacrylate (CyA) glue.

When making the stabilizer center fill piece, glue two pieces of

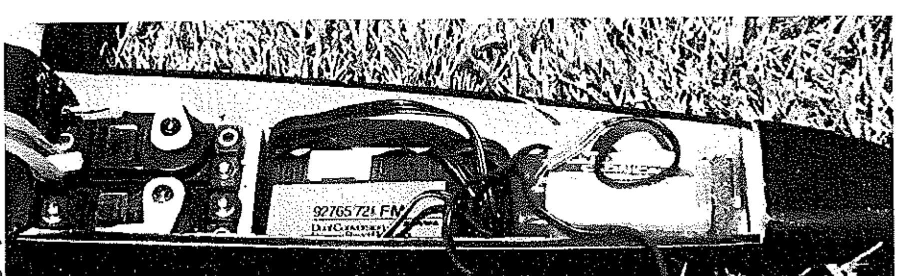
Graphic Design by Carla Kunz



Strider's open framework shows strength and simplicity of construction.



Author says that the fuselage design is "bulletproof" and crash-resistant.



Receiver, servos, battery, and switch fit in forward compartment ahead of wing.

3/16 sheet together so that the grain is spanwise.

The rudder is cut from a firm piece of 1/16 sheet. The 1/16 strips can be added with CyA. Be sure everything is kept flat and is well-bonded.

Fuselage: I recommend kitting the sides and bulkheads first and assembling them according to the plans.

To make the fuselage sides, cut the forward and aft 1/32 birch aircraft plywood doublers (two each). These must be exactly as shown; the forward doubler sets the wing incidence and the aft doubler sets the stabilizer decalage. This sets the trim and stability of the glider.

The fuselage sides are made from 3/32 x 2 x 36 hard balsa sheets. The sheets must be equal in bending deflection, dimensions, and they must be straight. Locate the plywood doublers on the balsa sheets. After checking that you have a right and a left side, trace the outline of the doubler on the sides.

I suggest using aliphatic resin for bonding the doublers to the balsa sides. Coat the areas to be bonded and let them dry to the point where they just lose their tackiness. With a clothes iron set to maximum temperature, apply pressure and heat until you have a complete bond. The 3/32 x 3/16 sticks may be added and the sides clamped together and match-sanded.

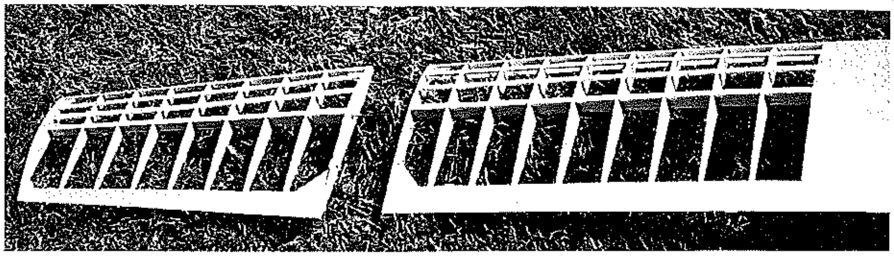
Bulkheads will complete the fuselage kit. For the balance of the fuselage construction, a 20- to 30-minute epoxy is suggested.

The wing leading edge and trailing edge bulkheads are critical load carriers. The layout for the control tubes and wing dowel in the forward bulkhead are most important. The holes for the rudder and elevator tubes must match the arms of the type of servos you plan to use, and the hole for the wing dowel should be canted up three to four degrees, as shown on the plans. Transfer servo mounting lines to the fuselage sides. Do not glue the dowels into the bulkheads.

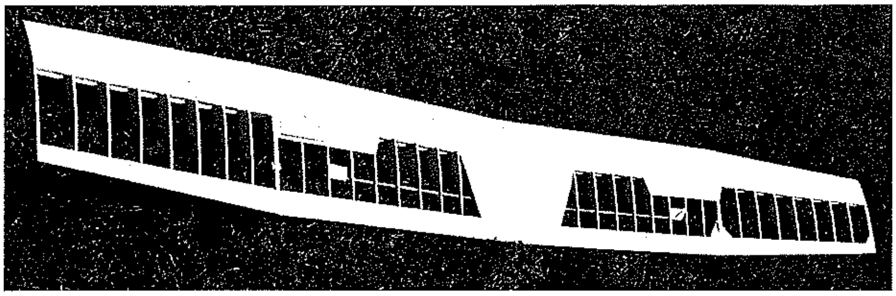
To assemble the fuselage sides and bulkheads, make a jig by cutting a block of wood from a piece of 2 x 6 that is exactly the width of the main bulkheads and is about five inches long. Drill a couple of clearance holes for nails and nail the wood over the top view of the plan. Clamp the sides to the block and glue the bulkheads in place, being careful to align the sides to the top view of the plan. Don't overlook the 1/32 plywood doubler on the bottom of the trailing edge bulkhead.

Glue on the bottom 1/16 balsa sheet. You may need a temporary spreader into the forward bay. Mark the 1/16 bottom plywood to shape (note that the plywood extends forward of the first bulkhead); cut and glue in place.

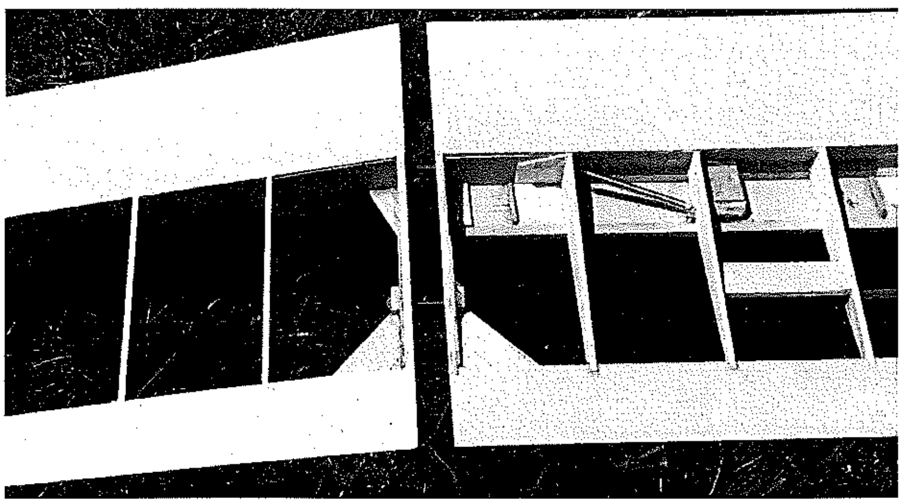
Install the fin leading edge 1/8 balsa mounting sheet on the fuselage top, and the 1/16 top sheeting from the stabilizer leading edge to the fin leading edge. Add the elevator and rudder push-pull tubes. The



Open-frame wing has no spoilers. Can be built as one-piece or three-piece unit.



Three-piece wing option with D-tube construction and spoilers.



D-tube wing permits winch launches. Note spoiler, joiner tube, panel connect.

RC STRIDER

Type: RC Two-Meter glider

Wingspan: 78.7 inches

Functions: Rudder, elevator, spoilers (Mk II)

Flying weight: 24 ounces (Mk I); 31 ounces (Mk II)

Construction: Built-up

Covering/finish: MonoKote

prototype used Sullivan carbon-fiber push-pull rods. They are very easy to install, are friction-free, and are very temperature-stable.

The nose block and the ¼ balsa sheet bottom fairing may be added now; be sure that they are fully bonded in place. The top aft 1/16 sheeting may now be completed.

Laminate the nose hatch from two ¼ balsa sheets, slightly oversize. Do not shape the underside of the hatch where it goes over the wing; that area must be shaped to fit the wing after it is completed. Lightly tack-glue the hatch in place.

Fair the nose, top and bottom, to the shape shown on the plan. Shape and install the ¼ triangular stabilizer mounting strips. The aft fuselage corners require only minimal rounding. The bottom forward fairing on the prototype was fiberglassed. This is strongly recommended; it increases the durability and strength of the nose.

The rear wing dowel may now be glued in place. The wing dowel in the front bulkhead should be a tight slip-fit; removal of the dowel facilitates access to the servos for installation or changing later.

Wing: Construction of the Mk II wing generally follows that of the Mk I, except for a few items noted at the end of this section.

The most important part of the wing is accurate ribs. The templates shown on the plans were traced from a CAD print that is accurate to .003 inch. For one or two wings, plywood templates will work, if care is taken while final-shaping. Stack/shape only enough ribs for one wing panel at a time, and use a straightedge between the templates while finish-shaping.

Check your building board for straightness. As you may have noted, there is no wingtip washout noted on the plan. The washout is designed into the wingtip; the airfoil progression produces aerodynamic washout.

You will need two tools to speed things along: a small miter box for cutting the vertical-grain spar shear webs, and a tool for the rib notches in the trailing edge.

The notching tool is easy to create. You will need to find two fine-tooth hacksaw blades taped or glued together with a 1/32 balsa spacer between them and a strip on the side for a depth stop.

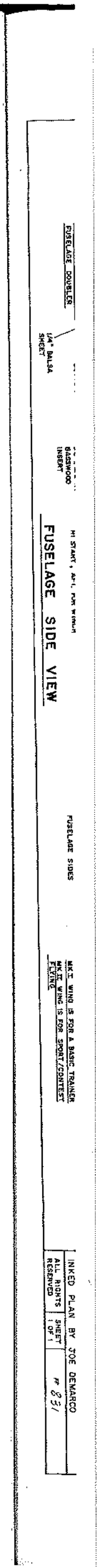
Start with the center sections. Pin the trailing edge and the 3/16 x ¼ basswood bottom spar cap to the plan. Note that the first three right and left center ribs are cut back 1/16 to allow for the center-section sheeting. At this point the bottom center section sheeting between the trailing edge and the spar may be installed.

The center rib should be bonded in place at the proper dihedral angle. The shear web for this bay should be installed on the front edge of the spar cap. A shear web at the tip dihedral joint will not be required; the plywood splice plate takes its place.

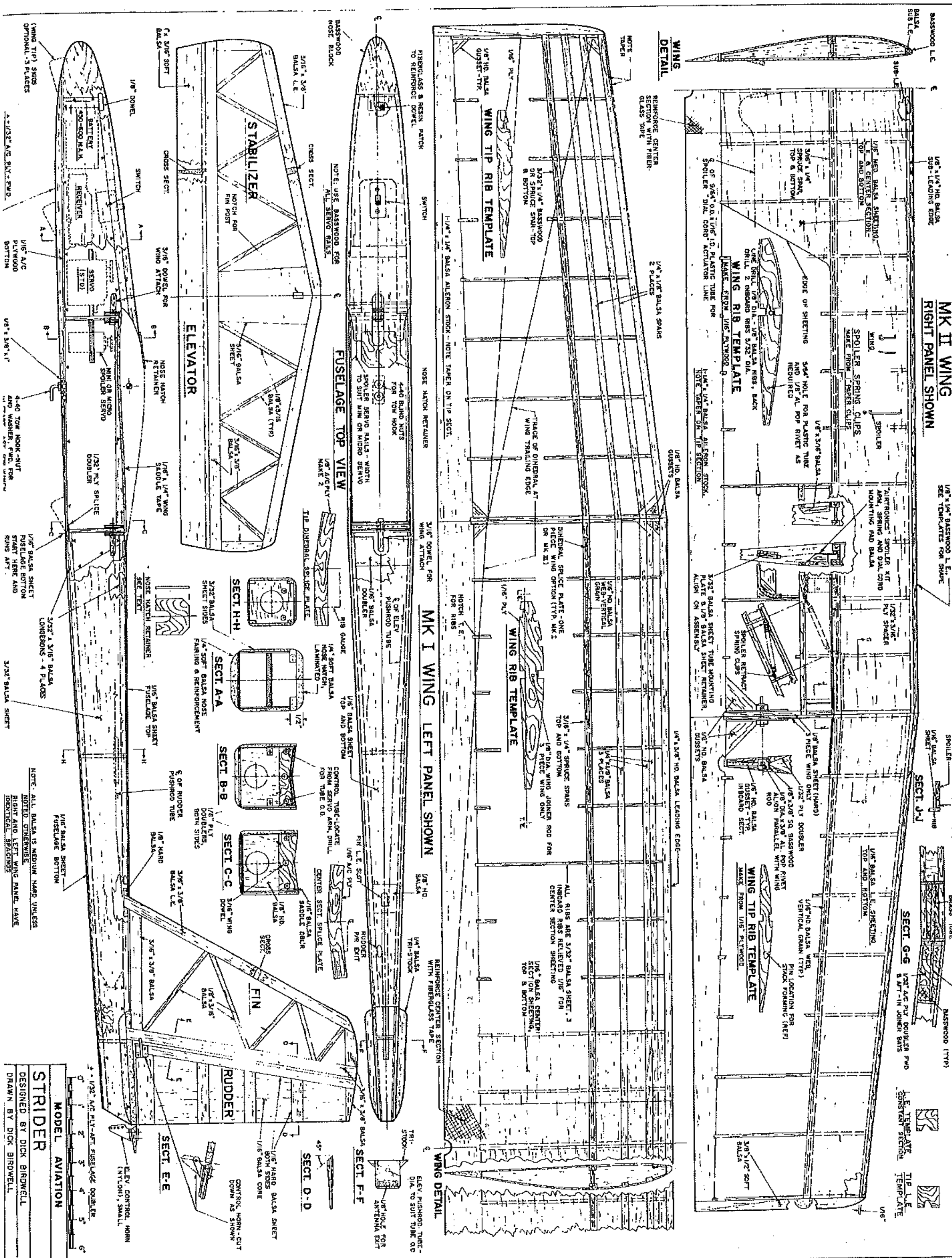
Bond the top spar cap, front fairing strips, and the leading edge The bottom fairing strip and the center section sheeting may now be completed. Do not install the top sheet aft of the spar cap until the panels are joined.

The wingtips are similar in construction to the center sections. The spar caps are 3/32 x ¼ and the trailing edge stock has a taper cut in its width to accommodate the thinning airfoil.

Before joining the wing panels, the leading edges should be shaped using the templates shown on the drawing. The leading edge of the tip is a little more complex, but is quite easily done if the 1/16 taper in width is done first. It will be helpful to control the shaping if the front of the leading edge is colored with a felt accent marker.



Full-Size Plans Available—see page 176



Join the center sections using the plywood joiner. The dihedral angle shown is important to the flight handling; more dihedral or less will have an adverse effect.

Complete the top sheeting. The fiberglass tape on the center section is a must, as this area has the highest stress of any part of the sailplane. Use a touch of CyA to hold the fiberglass in place while applying the epoxy finishing resin to the cloth. Attach the tips and the wing is complete, except for the final finish-sanding.

Mk II Wing: Five wing ribs will have to be modified as shown on the plan (for the spoilers). The leading edge is two-piece. The balsa sub-leading edge is for bonding the LE sheeting. After sheeting the LE a cap of basswood is bonded in place. When applying the sheeting with aliphatic resin dampen the bonding area with water to slow its setting.

Install the bottom sheet first. Weight the wing on a flat surface until dry. Do this for each sheet installed.

Note of caution on sheeting the tips: The stock edge of the sheeting must be trimmed so that grain runs as shown on the plan. If the sheet grain is in line with the spar, it may pull in a warp that will make the wing useless. If the Mk II wing has a built-in warp, it may be too stiff to correct.

Three-Piece Wing Option: The crux of this option is alignment. Stack-sand the four ⅛ hard balsa ribs together; while still pinned together, drill the ⅛ and 5/64 holes as located on the templates. Don't forget the 1/32 plywood plate fore and aft on the spar cap, boxing in the tube and wire.

Covering/Assembly: Finish-sand all assemblies and inspect to be sure that they match the plan. Always vacuum and wipe away all sanding dust with a tack cloth. Before covering the wing, balance it about the centerline and add weight as required.

It is strongly suggested that the Mk I wing be covered with MonoKote, for torsional rigidity. A less-rigid covering may allow a wing flutter to develop on launch or at high speed.

Do not use leaf-type hinges on the control surfaces. The slots required will weaken the structure and the gap decreases the control efficiency. The "covering" type of hinge is by far the best. If this is difficult for you, you may use Scotch™ plastic tape (catalog #190) on the flat side and in the V. Be sure to leave about 1/32 gap between the surfaces. Take extra care that the covering is well-bonded to the structure.

When installing the tail surfaces, be sure that the covering is removed from all bonding areas. Take a great deal of care in aligning the tail surfaces when bonding them place. Don't forget to install the wing-saddle tape.

Install the radio components according to the instructions received with the radio. When installing the push-pull rods, use short nylon clevises at the servo end. The control tube should not protrude more than ⅛ forward of the front bulkhead. A dab of epoxy at each bulkhead and at the top of the fuselage will fix them in place.

For control movement, locate the clevises in the servo output arms and the control horns so that at full servo rotation you have ±30° on the elevator and ±45° on the rudder with the transmitter's dual rate *off*.

For the first-time flier, set the rudder dual rate for ±30° and the elevator ±15°. After your flying progresses to a point where you learn that gentle stick movements work better than jamming or bumping the stick around, you should try flying with the rudder dual rate *off* for maximum performance. For general flying it is more relaxing to fly with the elevator dual rate *on*.

Flying: A successful first flight starts with a thorough preflight setup and inspection.

Inspect the wing for warps. If the flat underside of each wing panel lays flat on a level surface, the wing is perfect. If there are any warps in the wing, the model may be difficult (or impossible) to control on launch or in flight.

Attach the wing with four top-quality #64 rubber bands for launch on a hi-start (use five for winch launches). The nose hatch is held in place by the retainer shown on the plan. The retainer may be made from anything that is light, stiff, and about 1/32 thick. Fit the retainer under the wing rubber bands, and slide the retainer tangs over the aft edge of the hatch.

Set the Strider level, stand off a bit, and view it. Stand in back and check the control functions (if the stick is moved to the right, the rudder is moved to the right; same for the left. If the stick is pushed away from you, the elevator goes down; toward you, the elevator moves up.)

The balance point (Center of Gravity, or CG) shown on the plan should be marked on the bottom of the wing with a felt-tip pen. Add lead trim weight to the nose until the Strider balances. If it balances aft of the noted CG you will have less elevator control.

For the first flights, find a soft spot on the flying field for some hand launches to check trim. For the first hi-start or winch launch, have the club instructor (or an experienced pilot) make the first few flights.

The Strider has some very desirable flight characteristics not found on the average trainer. If you are caught in a area of sink or are downwind, put in a few clicks of down trim, push the stick forward to pick up some airspeed, then back to neutral, and it will move out like someone turned on a small afterburner.

After you are comfortable flying the Strider, start increasing the wing loading by adding ballast. The added weight really helps on a windy day, or when slope-flying.

For hot-dog flying you will have to go to full elevator travel because when inverted the model needs full elevator authority.

Try the Strider—you'll like it. Twenty members of my club, from novice to expert, have thoroughly enjoyed it.

My goal for 1997 is to use the Strider to complete League of Silent Flight Levels I, II, and III. ✈

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