A traditional aircraft design for the new builder

by Larry Kruse | Photos by the author

The idea for this model came from a telephone discussion with *Model Aviation*'s Editor-in-Chief Jay Smith, about a "beginners" theme he was planning for the May 2018 issue. The discussion centered around a design for those who had entered the hobby by way of RTF or ARF models, but who now wanted to build something of their own.

Central to that conversation was designing an airplane that would teach traditional building skills to the uninitiated, but would also be easy to build for anyone, regardless of the experience they brought to the project.

Having mentored five teams of high school-age students during the last five years as they built airplanes for a statewide competition, several things had become apparent to me. Because most of those students had never before built a model airplane, it was evident that one problem area was the daunting complexity of many of the available wood kits. That spoke to the need for simplicity.

They were not initially adept at handling and cutting balsa wood, so a small number of large parts with ample gluing surfaces needed to be incorporated in the design. Finally, covering a built-up framework with today's heat-shrink film posed many problems. That led me to an all-sheet-balsa model that would essentially be complete after it was assembled and sanded, thereby eliminating some of the complexity.

I have built three of my late friend Dee B. "Doc" Mathews' airplanes, originally kitted by Ace R/C and intended for four-stroke engines. I have never been so pleased with a series of designs in more than five decades of model building, and I was certainly influenced by their elegant simplicity and functionality.

I tried to incorporate those same principles in the little 30-inch shoulder wing aircraft that I sketched, requiring the builder to perform the time-honored tasks of the hobby—learning to cut balsa; assembling and gluing together a straight, well-aligned framework; and sanding it to an acceptable shape and smoothness after it was built.

These are all "old-school" practices and techniques that beginning builders could master and would serve them well as they became more than simply model consumers. In short, that's how Old School began as I sketched out lines to make the idea a reality. The name just seemed to fit.

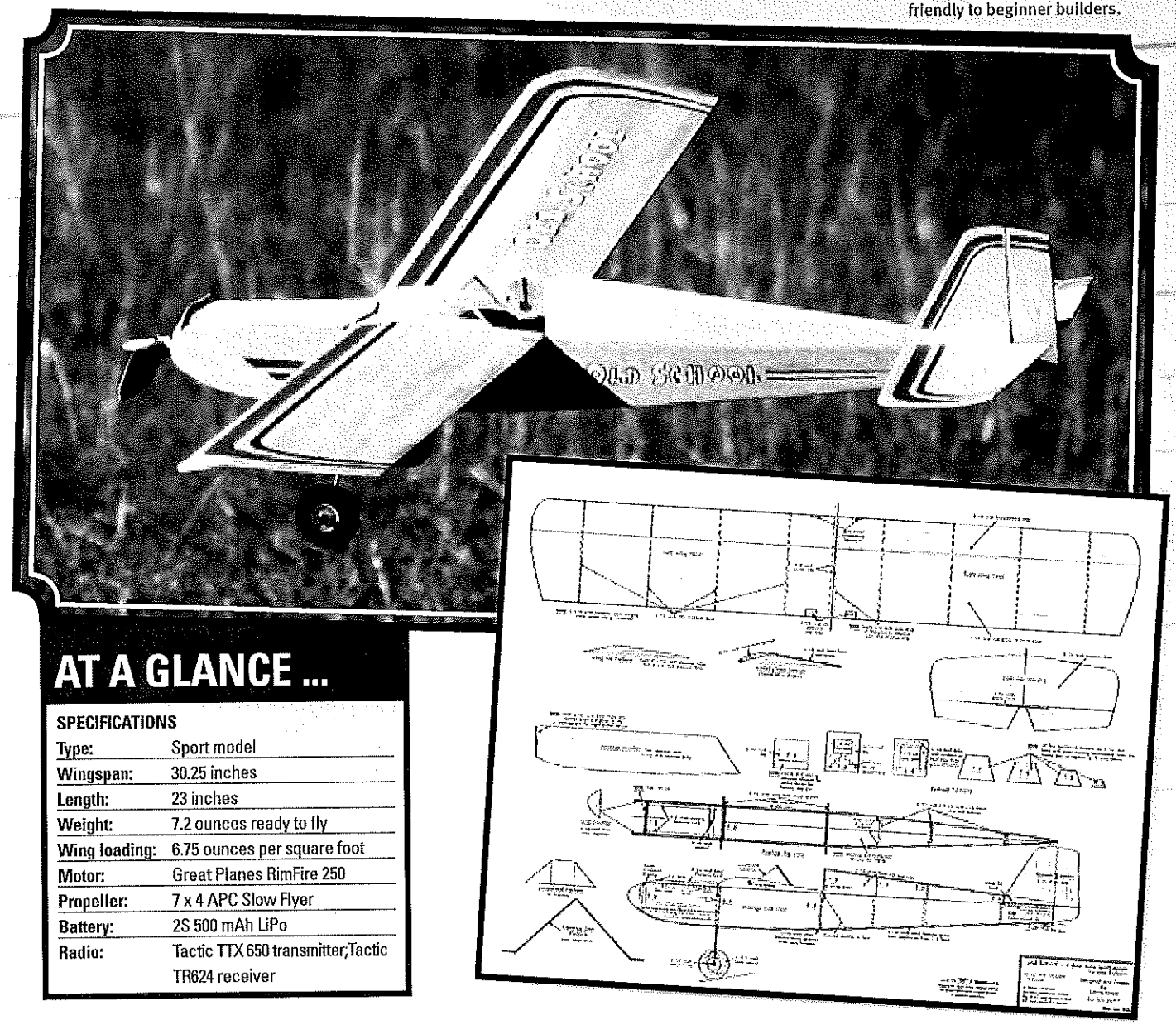
Preparing to Build

Getting the necessary wood, supplies, and powertrain together before the actual construction begins saves time at the start of any building project. Study the plans to determine what sizes of sheet and stick balsa, wire, plywood, and miscellaneous items, such as control horns and wheels, will be required to complete the model. It's also a good time to acquire the motor, ESC, and battery. I used the Great Planes RimFire 250, Silver Series 8-amp ESC, a 7 x 4 APC Slow Flyer propeller, and a 2S 500 mAh LiPo battery in the Old School; however, any equivalent power system would work.

Opting for a larger system would be problematic because of the increased weight and increased wing loading. In model building, weight is the enemy. Part of keeping the weight down is using only two or three thinned coats of clear nitrate or clear Sig Lite-Coat dope, and sanding lightly between coats.

The target weight for the airplane, including the power system, should be 7 to 8 ounces and no more. The prototype weighed 7.2 ounces, which was a comfortable weight for the setup.

The Old School is an enjoyable model to fly that is friendly to beginner builders.



AT A GLANCE ...

SPECIFICATIONS

Type:	Sport model
Wingspan:	30.25 inches
Length:	23 inches
Weight:	7.2 ounces ready to fly
Wing loading:	6.75 ounces per square foot
Motor:	Great Planes RimFire 250
Propeller:	7 x 4 APC Slow Flyer
Battery:	2S 500 mAh LiPo
Radio:	Tactic TTX 650 transmitter;Tactic TR624 receiver

Pre-Kitting the Airplane

Another time-saving technique is to "pre-kit" the model—that is to cut out all of the parts before starting the building process. As the photos show, all of the parts are simple and easy to cut out by making poster board templates to trace onto the appropriate-size balsa sheets. A soft lead pencil is better than a pen for tracing so that you don't leave ink residue that's hard to sand off.

A single-edge razor blade or X-Acto knife with a sharp blade will work well for cutting out the balsa parts, but I prefer to use a scalpel. There are only two plywood parts: the fuselage former F-2, which is 1/16 plywood, and the motor mount is 3/32 plywood. Both can be cut out using a razor saw, but a jigsaw or band saw will make for easier work.

Note the holes that are cut in the motor mount for cooling purposes. The holes don't have to be drilled to the pattern shown, but air openings for cooling will need to be made, depending on what motor you select.

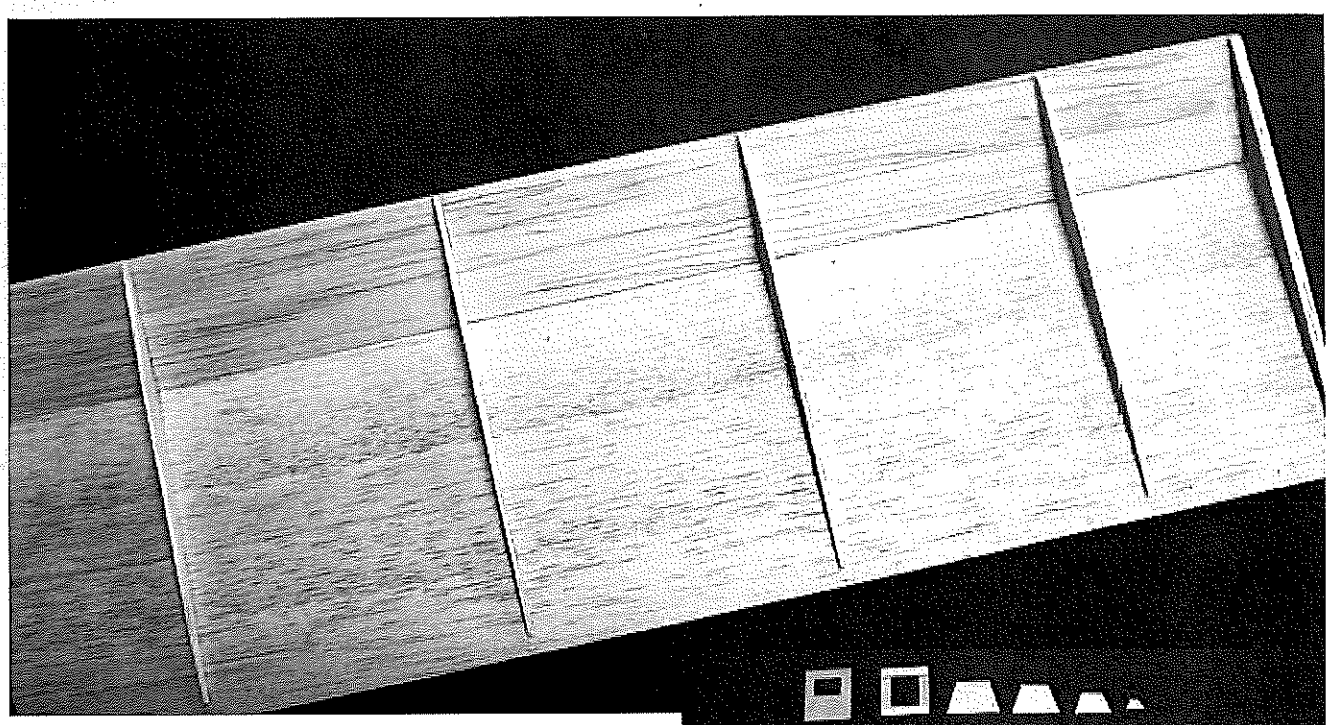
Building the Wing

The wing structure is slightly different than even an experienced builder might have encountered. I chose an all-sheet-balsa Jedelsky-style wing for its strength and simplicity. It is built using two sheets of balsa placed at an angle, creating an undercambered airfoil.

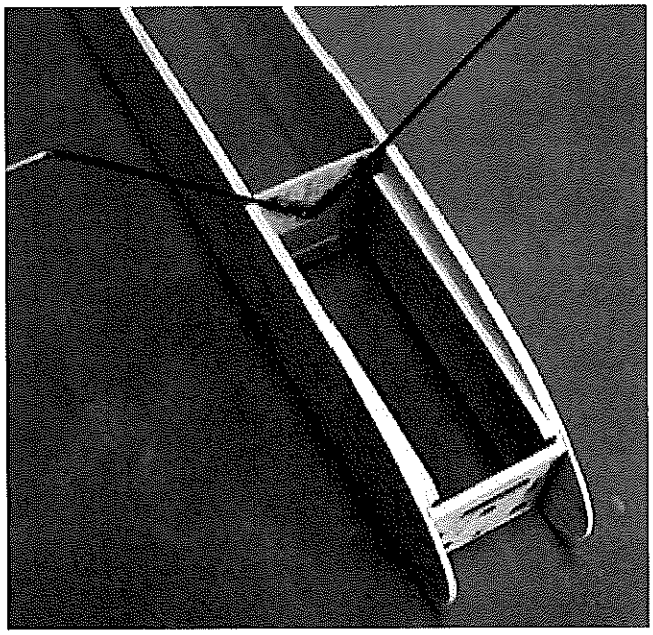
The triangular ribs serve as angle guides and then the upper surface of the wing is sanded to an airfoil shape. Although the Jedelsky wing is most often employed in Free Flight models, some notable old-school RC sport models, such as the 1970s Honker Bipe, used it to good effect.

After cutting out the two 1/16-inch main panels, mark the rib locations on the bottom side of each. Select one panel, pin it upside down to the workbench, and glue the triangular ribs in position, matching the rib's high point with the front of the panel. The 1/8-inch rib is glued flush with what will be the center of the wing.

After the ribs are dry, turn the panel over, again pinning it flat to the work surface. Now take the 3/16-inch leading edge (LE) and taper one side of it so it mates seamlessly with the 1/16-inch



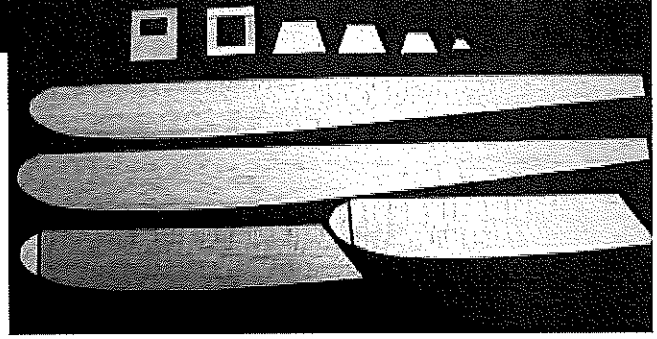
Above: The bottom of the right wing panel shows how the Jedelsky wing is constructed. Overhanging portions of the ribs, both fore and aft, are simply sanded on the bottom to a rounded shape after the wing is complete. That also holds true for the wingtip, which should be sanded to the outline shown on the plans.



The motor mount and the rails for the battery platform have been added in this photo. Note the manner in which the landing gear is stitched and then epoxied to former F-2.

panel. Put glue only on the top of each of the exposed ribs and set the LE in place, gently shoving it back against the full length of the $^1/_{16}$-inch sheet.

When it is dry, turn it over and glue the seam between the two pieces from the bottom side. Build the other panel the same way. After the two panels are complete, sand the top side of each $^3/_{16}$-inch LE to a rounded airfoil shape, using the template furnished on the plans as a guide.



The basic fuselage pieces are shown. Note the 1/16-inch doublers on the rear of former F-3, and the doublers for the fuselage sides. Follow the instructions in gluing up the fuselage side doublers, including trimming 1/32 inch off of the right side fuselage doubler after it is installed for the required right thrust, and waiting to glue in the nose doublers until after the firewall is epoxied in place.

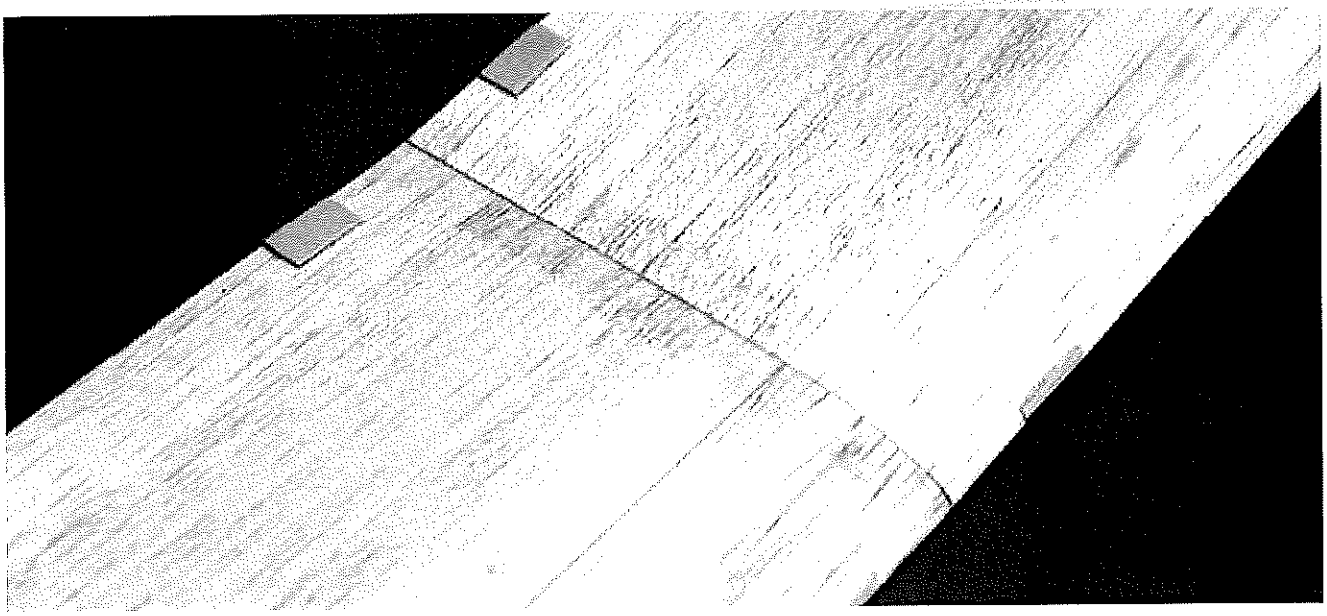
The dihedral angle is set by propping up each panel $1^1/_4$ inches at the tip, holding a sanding block vertical to the work surface, and gently sanding each center rib. Trial-fit the wing panels, sanding again as needed, and then pin down one panel while raising and supporting the other panel $2^1/_2$ inches at the tip.

Thick CA or epoxy can be used to glue the two panels together. Sand the wing, and then using thin CA adhesive, glue a $^5/_8$-inch strip of lightweight fiberglass over the seam to strengthen the dihedral joint.

Insert the split dowel rubber band bumpers in the LE adjacent to the fuselage, and add the plywood doubler plates to the trailing edge (TE) as shown.

Fuselage Construction

Some additional work needs to be performed before the actual fuselage assembly begins. The .062 music wire landing



The wing has a 5/8-inch strip of lightweight 1/2-ounce fiberglass attached with CA along the dihedral joint. The 1/32 plywood doubler plates are glued to the trailing edge, and split dowel "bumpers" are inset into the wing's LE to protect it from being indented by the hold-down rubber bands.

gear needs to be bent using the pattern provided on the plans then it needs to be "sewn" and glued to fuselage former F-2.

Instead of using a needle, I dragged roughly 1.5 inches of heavy carpet thread through a small puddle of CA glue. When the end of the thread had cured, it had sufficient strength to poke through the holes drilled in the former, just like a needle. After the thread is wrapped and tied, the gear wire and the thread can be coated with thick CA or epoxy adhesive for a solid mount.

Former F-3 requires $^1/_{16}$-inch doublers across the top and bottom for stiffness. When it is installed, they should face the rear.

Fuselage assembly starts with gluing the main fuselage doublers to the fuselage sides, also using thick CA. Make sure that you make a right and left side! These doublers face the inside of the fuselage. After they are set up and dry, place the fuselage sides over the side view of the plans and mark the locations of all of the formers and stiffeners using a soft lead pencil.

The fronts of the fuselage doublers are angled down to provide downthrust for the motor. Using a straightedge as a guide, trim $^1/_{32}$ inch from the front of the right side fuselage doubler to allow for the required right thrust. Install all of the vertical fuselage stiffeners in locations T-4 through T-6, but wait until the fuselage box is assembled to add the stiffeners and gussets to F-1, F-2, and F-3.

Pin the fuselage sides upside down over the top view on the plans with the doublers to the inside. Make sure both sides are perpendicular to the work surface. Now install former F-2 (the landing gear legs will be sticking up) and former F-3, using CA adhesive. Make sure that they are installed squarely and stay that way until they dry.

Epoxy the F-1 motor mount in place using pins or clamps to keep it against the front of the doublers until the epoxy cures. Be sure the right- and downthrust angles are maintained! Neatness counts to later allow easy installation of the rear triangular gussets.

After the three formers are dry, unpin the fuselage box and install the top and bottom crosspieces, using the top view of the plans as a guide for cutting them. As each piece is glued in place to the back side of its respective stiffener, keep checking the fuselage to make sure it remains square, and adjust as necessary.

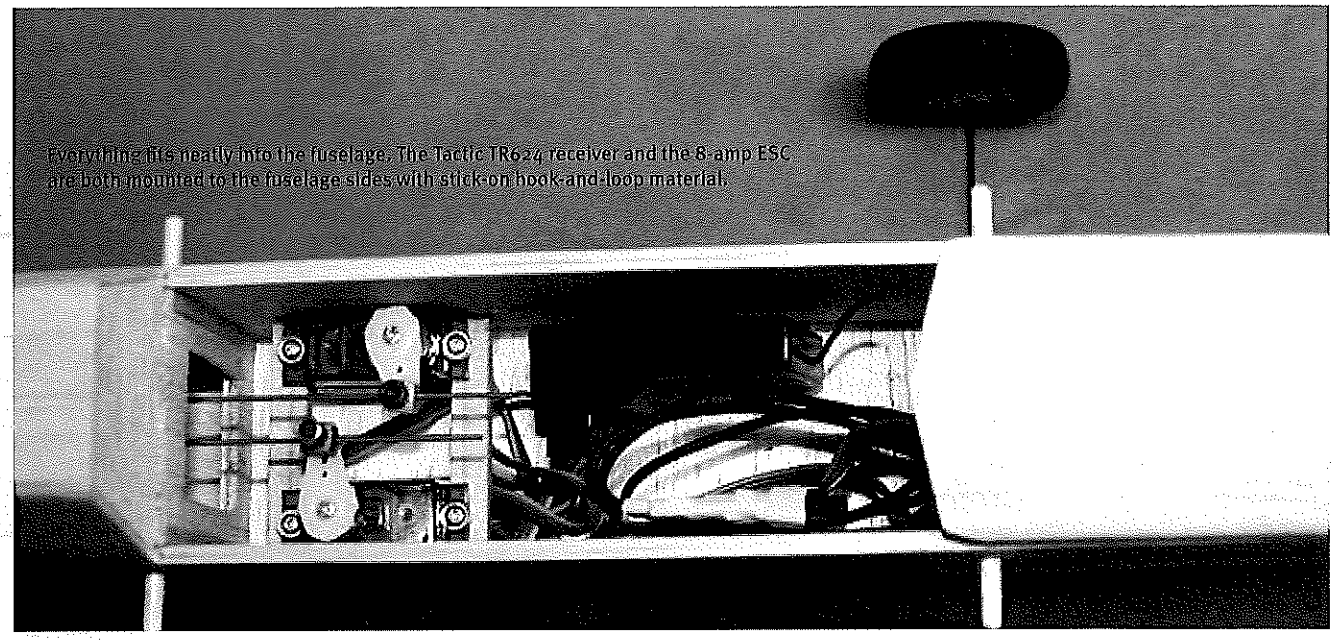
After the crosspieces at station F-6 are glued into position, pull the tail together and use a drop of glue to tack it in place until you can be sure it is square and not pulled to one side or the other. When you are satisfied, permanently glue it together.

The turtledeck formers T-3 through T-6 can now be added squarely on the top fuselage crosspieces. Be sure they remain vertical as they dry. Glue a scrap of $^1/_{16}$-inch balsa to the back of the T-3/F-3 joint with the grain running vertically. The turtledeck side panels are cut from soft $^1/_{16}$-inch wood, tapering the bottom of each panel so that it fits snugly along the fuselage side. Test-fit it in place and sand as needed.

Mark a spot approximately $^1/_8$ inch above formers T-3 and T-6 then place a straightedge over the two spots to cut each side panel to a long, triangular shape. First glue each side panel to the turtledeck formers. Keep the bottom of each side panel snug against the fuselage side then glue the fuselage/turtledeck joint from the inside of the fuselage box.

After both side panels are in place, sand the top of the panels flush with the turtledeck formers and cover the top with a triangular piece of balsa. Sand the top piece until it conforms to the side panels and round the top of the turtledeck. The goal is to make all seams as undetectable as possible.

The battery hatch is made from $^3/_{16}$-inch balsa. I found it useful to make the hatch full length from the motor mount back to the wing's LE, tapering it as



Everything fits neatly into the fuselage. The Tactic TR624 receiver and the 8-amp ESC are both mounted to the fuselage sides with stick-on hook-and-loop material.

shown. When you are satisfied with the shape, cut the hatch into two pieces $^5/_8$ inch behind the motor mount and glue the smaller piece in place as the front hatch anchor.

Make a $^1/_{32}$-inch plywood anchor "tongue" and glue it to the bottom front of the hatch as shown in the photos. The hatch is anchored with $^3/_{16}$-inch rare-earth magnets embedded in a $^3/_{16}$ x $^1/_4$-inch piece of medium-hard balsa and the bottom of the hatch.

Embed one of the magnets into the balsa piece flush with its top surface by drilling a small indentation and pressing the magnet into it, securing it with CA glue. Install that piece $^1/_2$ inch forward of former F-2. Stack the second magnet directly on top of the embedded one. Now insert the hatch tongue under the front hatch anchor as far forward as it will go. Position the hatch as perfectly as possible, and press it down over the stacked magnets.

The magnet on top will make an indentation in the bottom of the hatch, providing an accurate location for embedding the second magnet. Drilling a small indentation and gluing the magnet in place, flush with the bottom of the hatch surface, will be an easy task. However, make sure you maintain the correct polarity with the second magnet as you glue it in place. The hatch needs to deliver a satisfying click when it's closed, not pop up because of reversed polarity! Sand and taper the rear of the hatch as shown to fit over the wing's LE.

Add the battery platform, servo rails, and the two 9-gram servos while the bottom of the fuselage is still open and easily accessible. At this point, the motor can be mounted to former F-1 and the ESC attached. Drill holes for the wing mounting dowels and glue them in place. Use two #32 rubber bands on each side to hold the wing down.

The wire pushrods are .039 diameter lengths of music wire with Z-bends at one end. The other end fits into Du-Bro EZ Connectors mounted on the servo arms for adjustment. Poke the wires out through their respective openings, crossing them as they run from the servos out through the precut openings in the fuselage sides.

At this point, close the fuselage bottom using $^1/_{16}$-inch cross-grained balsa from former F-3 forward, and $^1/_{16}$-inch balsa running lengthwise from F-3 back. Note the air exit hole cut in the rear of the fuselage to provide adequate air flow over the ESC and other electrical components. The plywood tail skid can also be glued in place.

Tail Surfaces

The tail surfaces were presumably cut from medium $^3/_{32}$-inch sheet balsa during the pre-kitting process. The stabilizer/elevator and the fin/rudder can now be separated using a straightedge. Join the two elevator parts on top of the plans, epoxying a wooden dowel in place as the joiner.

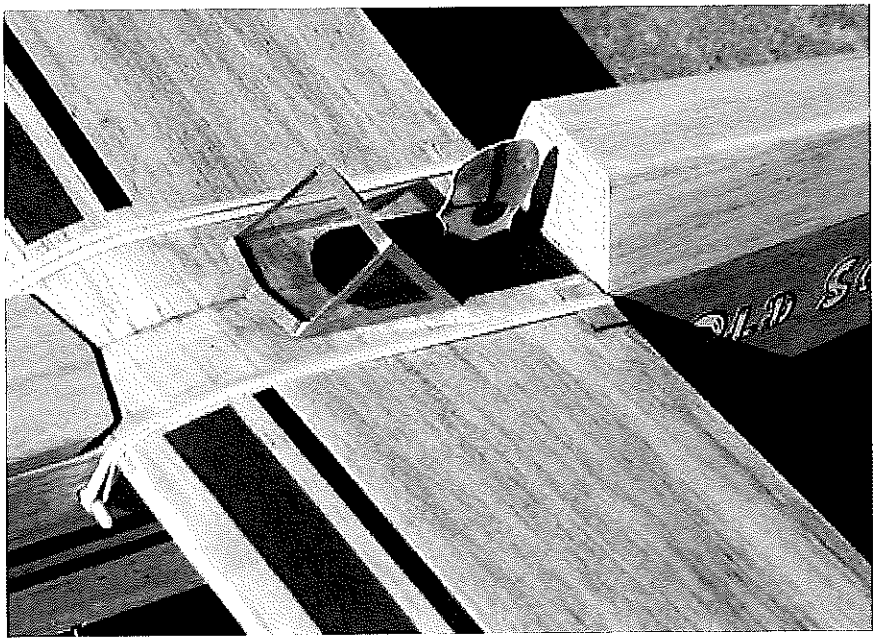
Sand the elevator LE and the rudder LE to a 45° chisel shape. Keep the stabilizer and fin TEs square, and round all of the other tail component edges. They can now be sealed with two or three coats of nitrate or Sig Lite-Coat dope thinned 50% and sanded gently between coats. The dope will provide moisture protection. After the second coat dries, the surfaces can be hinged using $^1/_2$-inch 3M Blenderm tape.

Hinging the tail surfaces with Blenderm can best be done by starting with the fin and rudder and cutting a strip of tape slightly shorter than the full length of the two pieces being hinged. Lay the two pieces flat with the hinge edges touching (but not jammed together) and the chiseled side down. Center the piece of tape you cut lengthwise (in the same direction as the wood grain) to the pieces and press it down. Now turn the joined pieces over and fold them flat against each other, keeping the hinge edges straight.

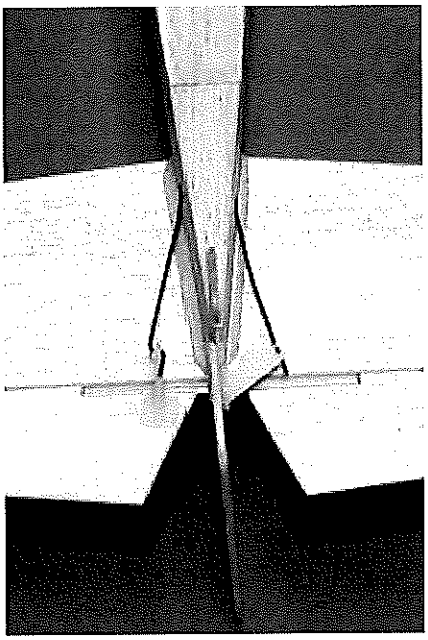
Cut two more 1-inch lengths of tape and place them horizontally across the grain of the folded pieces close to each end then unfold the joined unit. You should have free movement in both directions using this method. Hinge the stabilizer/elevator joints using the same technique.

Finishing

Final sand the fuselage and wing with



The cockpit area is dressed out with a card stock profile pilot figure that was obtained online and a windscreen cut and bent from lightweight celluloid and anchored with Pacer 560 canopy glue. The simulated cockpit opening is black tissue doped in place.



The pushrods for both control surfaces should first be threaded onto the horns. The horns should be glued with CA into predrilled holes in the rudder and elevator surfaces. Excess horn posts protruding through to the top side can simply be clipped off.

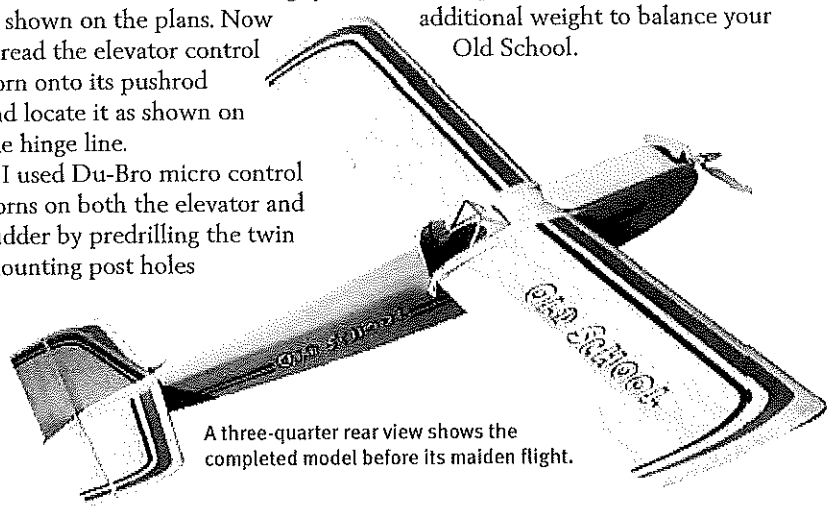
300-grit wet or dry sandpaper, and apply two or three thinned coats of dope to both, sanding gently between coats. The prototype has tissue trim attached by bleeding thinner through the tissue and sealing it with a final coat of thinned dope. Don't be tempted to load up the airplane with colored dope. The weight gain would be unacceptable.

Use two #32 rubber bands on each side to hold the wing in position and test-fit the stabilizer to its platform, sanding the platform if necessary to make sure it is squarely aligned from both the front and top view. When it's satisfactory, glue it in place. After it dries, sand two pieces of 1/8-inch square balsa to a triangular shape and reinforce the stabilizer/fuselage joint as shown on the plans. Now thread the elevator control horn onto its pushrod and locate it as shown on the hinge line.

I used Du-Bro micro control horns on both the elevator and rudder by predrilling the twin mounting post holes and threading the pushrods onto the horns. You can glue the horns in place with CA and let them dry then cut off the portion of the posts that stick up above the wood.

Treat the rudder in the same manner as the elevator, making sure it is vertical and squarely in line with the centerline of the fuselage. Hold it in place until the glue dries, then carve, sand, and add the tapered scrap blocks to either side for additional support.

At that point, installing the receiver and adding the wheels and windshield are all that's left to be done. Balance the airplane as shown by shifting the battery as required. On the prototype, the battery was placed directly against the front of former F-2, which proved to be perfect. I hope you will not need additional weight to balance your Old School.



A three-quarter rear view shows the completed model before its maiden flight.

Flying

The first flights can be rise-off-ground because the RimFire 250 motor has plenty of power for a model of this size. Takeoffs are smooth by adding power gradually and a shade of rudder control to keep it straight on the runway.

It is a predictable and stable flier, both at low speed and at the top end of the throttle. You can expect flights of 6 to 8 minutes or more flying at mid-throttle. Landing the airplane is easy, even in moderate breezes. Simply throttle back and let the Jedelsky wing do its work. It will slow down almost to a hover when faced into the wind and will land within 5 or 6 feet.

I hope you will enjoy the Old School as much as I did designing this special airplane for new builders.

—*Larry Kruse*
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SOURCES:

Hobbico/Tower Hobbies
(800) 637-6050
www.towerhobbies.com

APC Propellers
(530) 661-0399
www.apcprop.com

Du-Bro
(800) 848-9411
www.dubro.com

Sig Manufacturing
(641) 623-5154
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