



■ Dave Robelen

*This Prince won't
make you a pauper!
It's an economical, fun RC sport design*

Prince



The author prepares his sporty, original model for flight. This RC model is low-stress, fun, and easy to build.

FOR QUITE A few years I have enjoyed flying medium-size sport aerobatic models. These are usually powered with .25-size engines and are quite agile. Generally, the designs I have been using have been built quite sturdy to take rough handling and have been equipped with fairly heavy Radio Control (RC) gear.

Partly as a result of becoming involved with electric RC models, I have become aware of a variety of weight-saving structural techniques and have found much lighter RC gear that is well suited to this class of model.

I have long admired the styling of the early Pattern models, and I decided to adapt this appearance to my latest effort.

Meanwhile, it became clear that all but the smallest of the new microserves would have sufficient torque for the intended loads. The loads I am referring to are the *air* loads—not stiff hinges plus air loads. I have seen hinge installations that would be excessive on a closet door, let alone a light model!

I have had success with the flexible plastic hinges cut into strips ¼-inch wide and fastened with thin cyanoacrylate (CyA) glue. The pin-type hinges would also work fine as long as the hinge gap was kept tight.

Having chosen a format and equipment, I decided to use my trusty O.S. .25 FP engine for power. In keeping with the theme of lightness, I chose to use wooden beam mounts which spread out the engine loads better.

The wing is tapered for several reasons. One is that it requires less aileron force to get the desired roll response. The damping in gusts is improved, and a tapered wing is stronger at the same weight. Strip ailerons were selected for their simplicity and reduced servo loads. They have proven to be more than adequate.

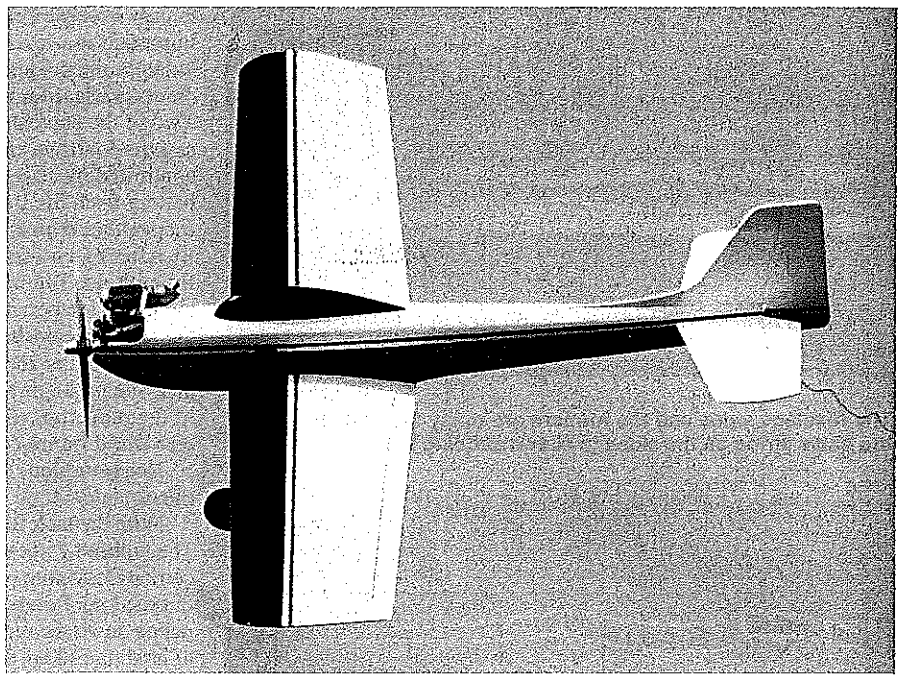
The airfoil was chosen as a result of recent successes with

other projects that had similar requirements. The range of speed is outstanding, and the low-speed handling is equally delightful. Prince will snap-roll and spin, but you must make a clear-cut effort with specific control inputs to achieve these maneuvers.

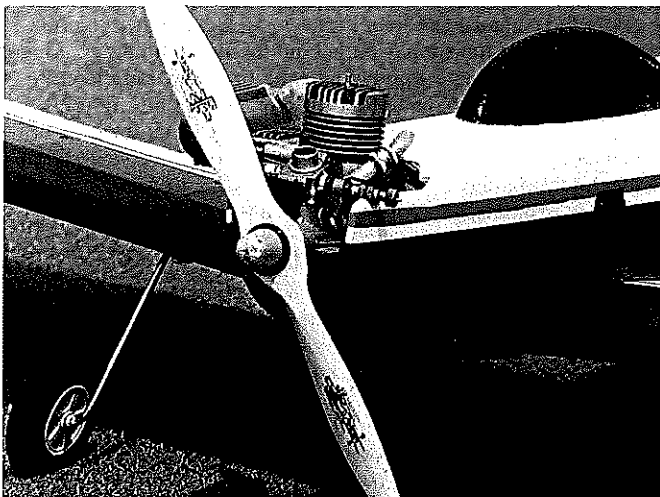
The tail size was chosen as a comfortable compromise between snappy maneuvers and an adequate tolerance to center-of-gravity (CG) placement. There will still be one best balance location, as we will see in the flight-trimming phase. The fuselage moment arms were selected to gain a good compromise between snappy maneuvers and smooth tracking in turbulence. Because of Prince's light weight, I ended up placing the battery in the tail cone to achieve proper balance.

When I built the prototype I avoided using excessively soft, light wood, and I worked with a medium grade for most of the structure. The one location where I deviated was the wing spars, which are a very hard grade of balsa. I used enough corner stock in the fuselage to allow a pleasant rounded shape. (This also helps reduce drag.)

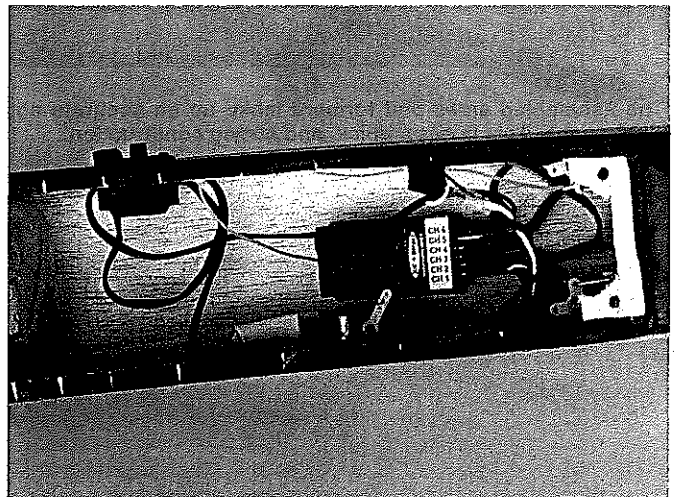
My covering of choice is MonoKote®,



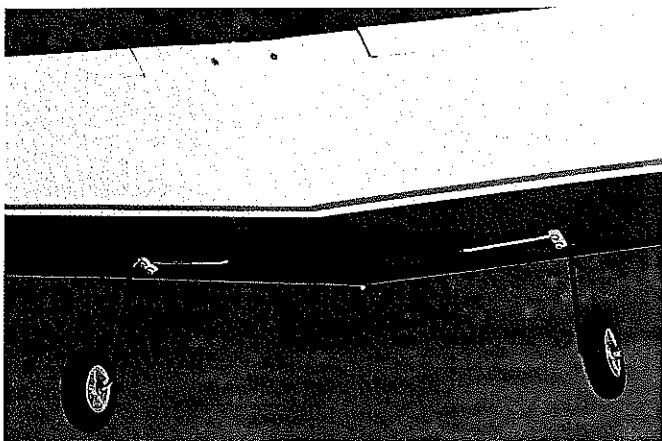
The Prince is stable in flight and is capable of impressive aerobatics. It has the flavor of the Pattern models of the 1970s. This is an economical aerobat!



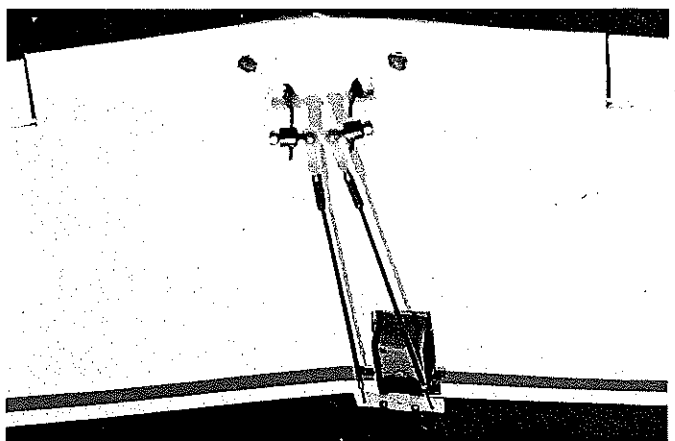
An O.S. .25 resides in the engine room, and it swings a Zinger 9 x 5 wood prop—the right blend of power for this model.



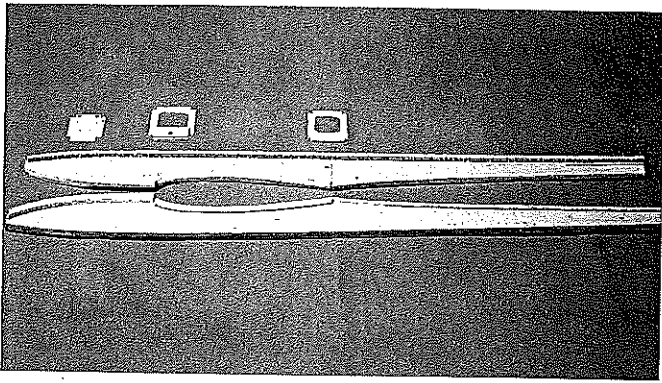
There's ample room in the fuselage for radio gear. The author prefers servo tape for mounting servos—a light, quick option.



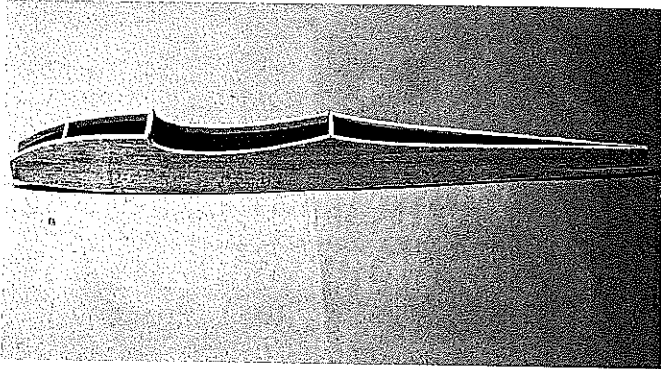
The main landing-gear struts fit into gear blocks in the wing and are held in place with nylon straps. It's quick and easy!



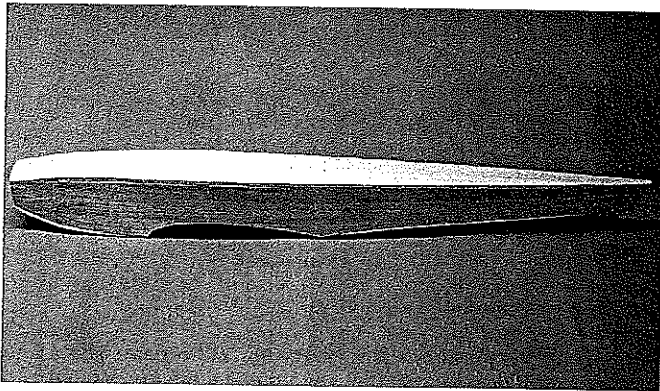
One servo handles the aileron operation in this design. Note ball-link attachment to aileron-horn uprights. No slop here!



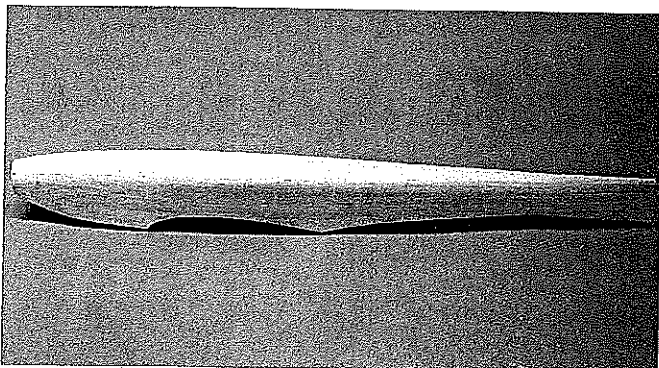
The fuselage sides and the formers are ready for assembly. Note the balsa strips on the sides to allow rounding later.



The assembled sides and formers make up an accurate and rigid crutch. This is easy, quick, and strong construction.



The balsa top and bottom blocks have been added to the crutch assembly. Now the fun begins with carving and sanding!



Looks great, doesn't it? Properly done, the result is a smooth, fluid shape. Block carving is not difficult to learn.

mainly because I am familiar with how it works. It is also important to use a stiff type of covering on the wing frame to avoid problems in flight.

As is usual for me, I ended up with a mixed bag of equipment. Two of the servos are miniature JR units, another is from Hitec, and the fourth is an ancient miniature Kraft unit. All these are controlled by a six-channel Berg receiver and powered by a battery from SR Batteries. Signals come from a Hitec Prism 7x transmitter, which is a delightful unit.

After much fussing over details, I finally got the model to the flying field. The weather was super, with light winds and moderate temperatures. Things started off on a shaky note when the range check showed practically no range and poor control over the rudder servo. Off came the wing for a look-see. The only possible problem was the receiver antenna laying against the side of the rudder servo. I moved the antenna well away and fastened it to avoid future contact.

Reassembled, the range checked normal! This was a new one for me.

With the tank filled and all else finished, I cranked up the engine. The faithful .25 never sounded better, so the moment was at hand. I carried Prince out onto the grass runway, got into position, and throttled up. Prince chose to nose up onto the propeller instead of racing down the runway! The next attempt was successful as a result of holding full up-elevator until the model lifted.

The flight itself was a dream, with smooth rolls, huge loops, and sweet slow flight. When it was time to land, the approach was flat with a lovely flare (if I do say so myself), and Prince proceeded to flip onto its back when it touched down! It repeated this aggravating behavior several more times while I continued to explore the maneuver possibilities.

Returning to the shop, I pulled out the thin landing-gear legs I had installed to save weight and bent up a new, stiffer set. Problem solved!

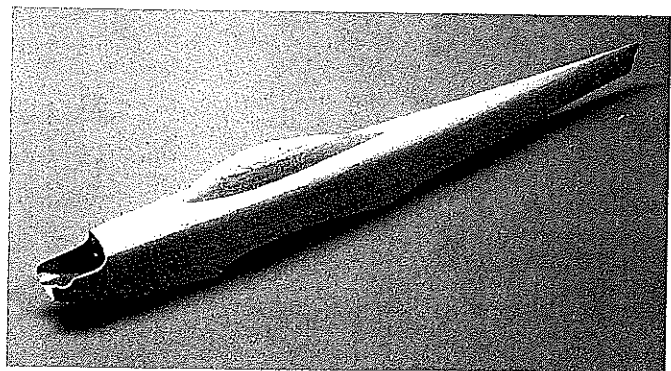
The next time out, Prince was a real pussycat on the ground and handled the grass with no problem. This next session was on a much breezier day with ample turbulence, and I was pleased with how Prince handled the wind. Clean and powerful, no maneuver presented problems.

CONSTRUCTION

If you want a Prince for yourself, there's just one catch: you have to make it! I suggest that you have a few kits under your belt before tackling this project. It's not so much that it is difficult to build or fly, but a precision building job will really pay off, and you will be better equipped to handle this spirited aircraft.

No special tools are required, but a Dremel®-type jigsaw is a big help now and then, as is a Dremel® Moto Tool. The rest of the equipment is the usual shop tools. Please be sure to use sharp knife blades and sandpaper; the results are much nicer.

A good, flat work surface is a must. It should be something you can stick pins into and be large enough to accommodate the largest part. Several types of soft ceiling and wall board will work fine, as long as they are placed on a flat surface.



With the addition of a sleek, carved balsa canopy, the model takes on the look of a classic RC Pattern design.

You will need a surface to cut on that will be kind to your knife blades. At a windshield dealer I found some scrap plastic that was reasonable and works really well. Lexan® is best, but Plexiglas® does fine. A metal yardstick or a piece of storm-door edging is a big help in making long, straight cuts.

I did all of my building with medium CyA, with help from thin CyA on the hinges and epoxy around the nose for fuel-proofing.

You may be able to find all the materials in a well-stocked hobby shop. If not, there are several excellent mail-order firms for balsa. I have dealt with Superior Balsa with good results, but others are fond of Lone Star Balsa in Texas.

The main thing is to remember that you are building a custom model and the materials you use will have a big influence on the outcome. A medium-grade weight is excellent for the thinner sheet parts, while the top plank and canopy should be a lighter grade of wood. The wing-spar sticks should be a hard grade of balsa.

When you are cutting the parts, do not slice up the plan sheet. Make copies of the small parts on an office copy machine, and trace the larger parts onto a separate sheet of paper. I have had success using a glue stick to tack the patterns onto the balsa sheets. It works especially well to glue two layers of balsa together when cutting the wing ribs. Use the glue stick sparingly, and pull the pieces apart soon after cutting. The glue-stick adhesive tends to become permanent with time!

The straightedge is handy when cutting the strips for the wing leading and trailing edges. Please note that the leading-edge strip tapers in depth from root to tip. It is a good idea to shape the trailing-edge strips before clamping them on the board. Do not cut the ailerons free at this time! That should be done after the wing frame is assembled and sanded.

Warm up by cutting out the tail surfaces. A couple of the parts have a splice line to be able to use three-inch-wide wood. Install the elevator joiner before cutting out the center, and the elevators will line up much better. The hinge lines on the rudder and elevator should be sanded to a sharp bevel, and the rest of the edges should be smoothly rounded. Set aside for now.

Fuselage: Build the fuselage by making two side assemblies with all the strips and doublers glued in place. Hold the assemblies together, and make certain that they are alike (one left and one right) before proceeding. Hold off on installing the engine mounts for a bit.

Glue the F2 and F3 bulkhead assemblies to one side, then add the other side. Check carefully to make sure that things are straight and square. Trim the corner stringers, and glue the sides together at the tail.

Glue the firewall in after drilling the various holes that match your tank plumbing. Now the engine mounts can be installed; take care to ensure that the surfaces the engine mounts on are lined up with each other.

Glue the top plank on and the rear bottom sheet, and you are ready for some serious shaping. I prefer the X-Acto™ whittler's blade for this job, but as long as your knife is sharp, go for it! Leave the nose bottom open until the wing can be fitted and the dowel located. Decide on your model's canopy; if it's balsa, go ahead and shape that now. I prefer to hollow out the inside after it's covered because it's much easier to hold that way.

Wing: The wing is divided into two phases: assembly and shaping. Assuming you have all the parts cut, clamp the bottom spars to the board. Use a couple of wing ribs as spacers, and clamp the trailing edges in place. The ribs should be glued to these two strips now, fitting carefully. Cut and install the spar webbing, and fit and glue it in place. Follow with the top spars and leading-edge spars.

When all this is solid, clamp the leading-edge strips in place and glue. Once the glue is dry, lift the panels and install the center sheeting and the landing-gear mounts. Mount the tips, and prepare to smooth and shape the two panels. It will be a

Prince

Type: RC sport Pattern

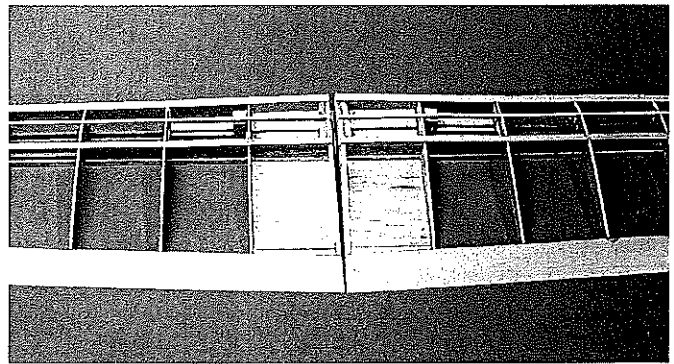
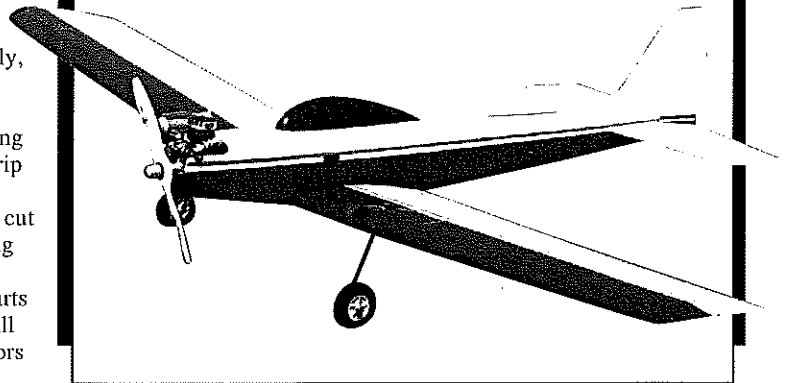
Wingspan: 51 inches

Engine: O.S. .25

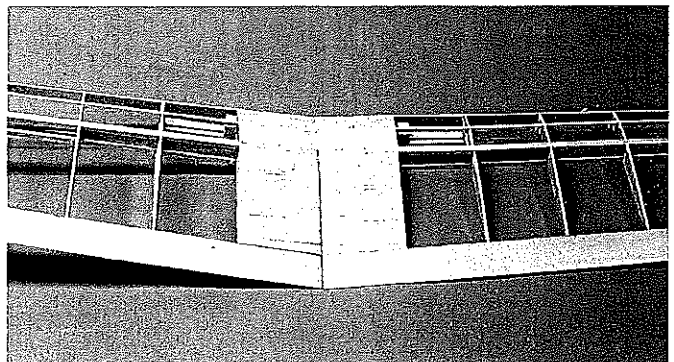
Flying weight: 2 pounds

Construction: Built-up balsa and plywood

Covering: MonoKote®



The wing halves are ready for joining. Note the landing-gear block installation and the ample sparring. It's strong and light!



Wing halves have been joined with the proper dihedral angle, and the top sheeting has been added. Nothing difficult here.

big help if you use a fine-tip felt marker to lay out the center of the leading-edge radius (this is not in the center of the strip). Carve and sand the panels smooth, with the leading edge shaped as shown on the plans.

Make the center joint by trimming a slight bevel on the ends of the panels and touching it up with the sanding block until the two fit together perfectly. I used medium CyA to glue the halves together.

This is the time to cut the ailerons free. Be sure to cut all the way across the center-section so that you will have a piece left to glue over the linkage. Shorten the ailerons approximately $\frac{1}{8}$ inch for free movement, and sand a bevel on the leading edge.

I made my torque rods from $\frac{1}{16}$ -inch-diameter music wire with $\frac{3}{32}$ -inch-outside-diameter-brass-tubing bearings. Cement the bearings to the wing, trimming away any wood that will affect movement. Trim away a channel in the piece of trailing edge, and glue it back over the torque rods. Make sure everything moves freely, and glue the plywood bottom plate on the trailing edge.

Final Assembly: Fit the wing to the fuselage, trimming and sanding the opening as necessary for a snug fit. Measure carefully to ensure that the wing is really in the center and not twisted. When satisfied, drill and tap for the 10-32 plastic bolts and screw them in, trapping the wing.

Holding the front of the wing tight in the opening, drill into the wing leading edge through bulkhead F2 for the front dowel. I prefer to use brass tubing for this dowel, but you can do your own thing. It has been my experience that wood on wood wears out too quickly.

Set the dowel aside for now, and decide if you want to put a band of fiberglass around the wing center. I chose not to after bending the wing frame and verifying the strength. If I had used fiberglass, I would have bonded it with thin CyA.

Plank the chin of the fuselage, and shape to the final section. This is where I covered my Prince with MonoKote®—while all the pieces were still separate. Considering how my covering jobs turn out, my best advice is to read the instructions carefully and follow them. Your Prince will probably be smoother than mine!

Glue the wing dowel in place in the wing, and fasten the wing to the fuselage. It is very important when you mount the tail feathers that you line them up with respect to the wing and the fuselage.

Since the canopy contributes to the flying qualities, don't leave it off. The $\frac{1}{8}$ -inch-wire landing gear requires some serious effort to make the bends, but it is worth it. I used an old shop vice, a hammer, gloves, and sweat to get mine bent. A single strap on each leg should be

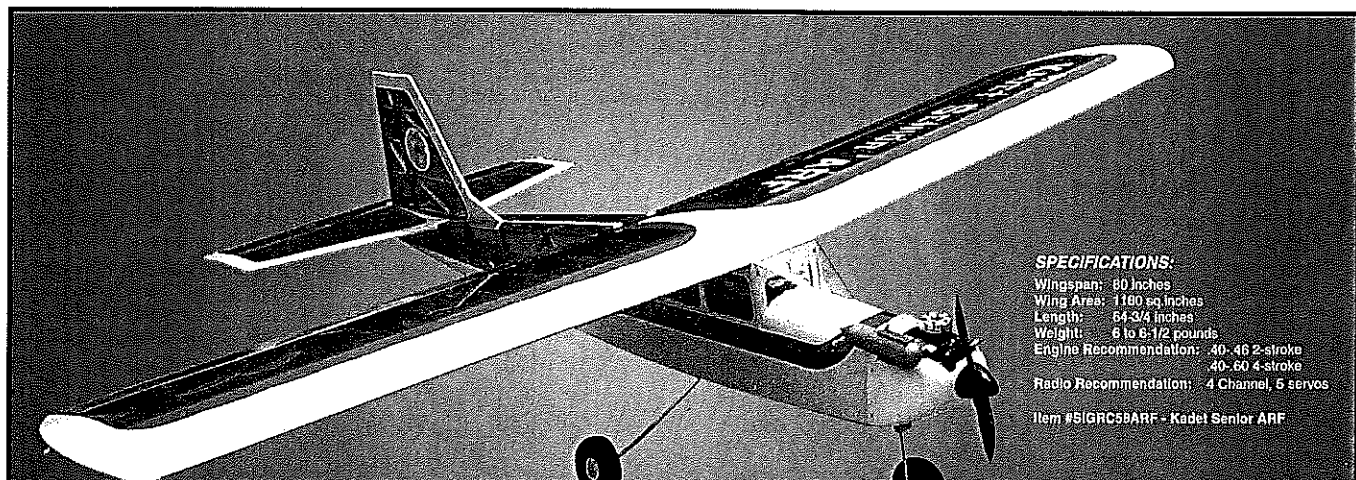
plenty to hold the gear in. The wheels are the Dave Brown Lectra Light treaded, which work really well.

My engine is held in place with #4 x $\frac{1}{2}$ -inch sheet-metal screws, which works really well for me. Just drill a $\frac{1}{16}$ -inch pilot hole before driving the screw in. The fuel tank is a Sullivan four-ounce RST type, with the metal tubes protruding through the firewall. Please be sure to use a fuel filter, and fill the tank on the tank side of the filter!

My throttle linkage is a combination of a thin Sullivan guide tube with a .020-inch-wire throttle rod. I used the Sullivan hardware to make the connections. My control horns are small Goldberg on the tail with Goldberg snaplink connectors. The pushrods are $\frac{3}{16}$ square balsa with wire ends. The tail wheel is mounted directly to the rudder using a .046-inch-wire strut that I bent a coil in for shock protection. It works great!

Since I am a fan of servo-mounting tape, all the servos in my Prince are mounted this way. I do glue patches of thin plywood to the balsa where the tape will make contact for better adhesion. The aileron hardware on my model is Du-Bro strip aileron linkage used stock.

Now is a good time to assemble your Prince and check the CG before permanently mounting the battery. With the O.S. .25 and a 9 x 5 wood propeller, my Prince balanced just right with a 350 mAh battery behind the wing. Mount your



SPECIFICATIONS:

Wingspan: 60 inches
Wing Area: 1100 sq. inches
Length: 64-3/4 inches
Weight: 6 to 6-1/2 pounds
Engine Recommendation: 40-48 2-stroke
40-60 4-stroke
Radio Recommendation: 4 Channel, 5 servos

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switch harness and give things a good going over, then charge the batteries in the model and the transmitter.

I hope you were able to get some running time on your engine before heading out with a new airplane! The setup that has worked well for me is a 9 x 5 Top Flite Power Point propeller, 5% fuel, and a K&B Long Reach Idle Bar glow plug. If you are having engine troubles with some other setup, please try it my way.

Flying: This is the easy part! Set the elevator for 1/2-inch up and down, the ailerons for 1/4-inch up and down, and all the movement you can get on the rudder. Make sure the engine idles well and recovers to full throttle before proceeding. Set the needle valve for maximum rpm with the nose pointed up 30°. Depending on your field conditions, you could taxi out onto the runway or carry the model out.

With Prince pointed into the wind and the elevator full up, slowly advance the throttle toward maximum. As soon as the speed builds, relax the elevator until you pull it back gently for a smooth liftoff. Climb up a way before messing with anything while you observe any needed trim adjustments.

With the throttle at roughly 50%, set all the trims for straight-and-level flight. Idle back and pay attention. Does the nose want to drop at low power and

require you to hold constant back stick? I'll bet your Prince is nose-heavy. This will also show up as needing a great deal of elevator to flare for landing. If Prince is tail-heavy, you will find that the elevator is painfully sensitive and it will be difficult to hold level flight.

Having come this far in building a custom airplane, take the time to get things such as the balance correct. When Prince is balanced properly with approximately a half tank of fuel, the transition from full speed to gliding should require little attention at the stick. As for the final control-throw settings, you will need to "season them to taste."

If you develop a desire for more serious aerobatics, check out the numerous books available and try to find an actual "expert" to give advice.

I hope things go well for you and your Prince. Let me know if I can be of help, and if you take a picture I would love to see it. *MA*

Dave Robelen
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Further Specifications:

Length: 34.5 inches
Wing area: 402 square inches
Wing loading: 10.9 ounces/square foot

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