



# SKY KNIGHT

**T**here has been a need for a simple to build and easy to fly trainer ever since the first R/C models became popular. This type of model has traditionally been powered by a glow engine which is not the easiest device for a novice to master. You have to have the right glow plug, the right fuel, the right tank installation, and, woe to you, if you get dirt in your fuel lines. There seems to always be a problem in getting the needle valve adjusted. How many times have the engines quit just prior to take-off or during your first loop. I have observed that the new R/C flier with the traditional

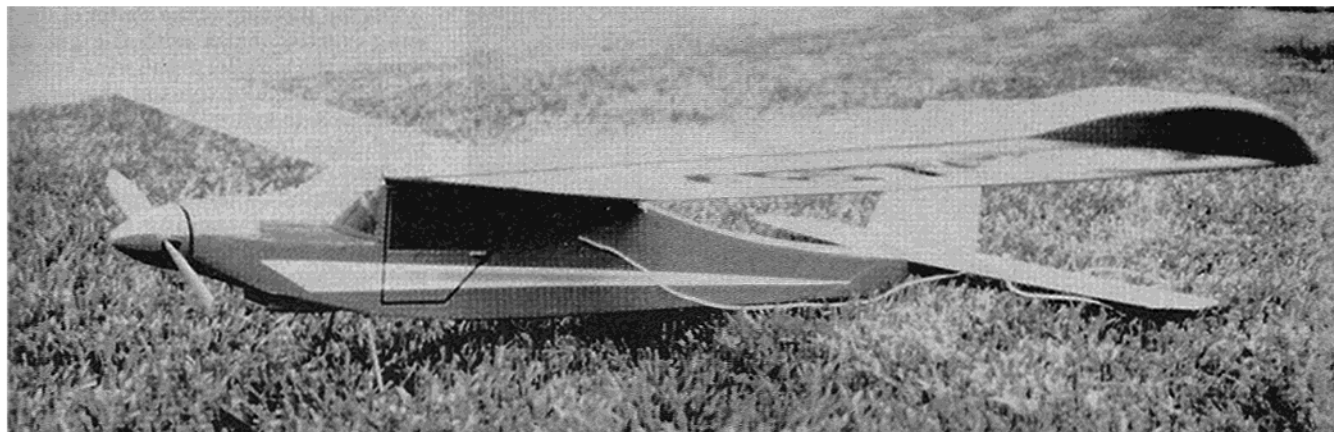
**Get started in electric with this simple to build and easy to fly electric powered sport trainer.**

**By Jim Zarembski**

trainer spends more time fiddling with that darn engine than flying. What are the options? Sailplanes appeal to some beginners but what about those who want a propeller driven model that looks something like a real airplane? Up to a few years ago there really weren't a great deal of

choices but in 1986, electric power is the easiest way to power your trainer.

The Sky Knight has been designed as a Sport Trainer with the novice in mind. It's lightweight, easy to build, and very easy to fly. The electric motor always starts the first time with the flick of the throttle control on your transmitter. This rugged little model is quite docile when minimum control movement is used. However, once you've mastered the art of R/C flying, rudder rolls, spins, loops, and all sorts of wild aerobatics, are easily performed with the Sky Knight with full rudder and elevator control. With either the Leisure, or the newer Astro



05 with six Sanyo 1200 mAh cells, flight duration is in the 10 to 12 minute range. In fact, several of the builders of the prototype Sky Knight models have been expert fliers looking for a snappy little sport ship to fly in schoolyards, parks, and to put in the back of the family car on vacation trips.

Hopefully, you're interested in trying the Sky Knight by now. But first the model must be built.

If you've never scratch-built an R/C model before, don't be frightened away. The simplest method is to trace all the parts on tracing paper or vellum and rubber cement these outlines to the required balsa wood and plywood. The balsa components can be cut out with a hobby knife such as the X-Acto with a #11 blade. The plywood could be cut with a hand jig saw. However, both the balsa and plywood parts are most easily cut out using a powered jig saw. I have a Dremel unit which I have found invaluable. No workshop is complete without a jig saw or band saw.

For those parts, such as wing ribs, that are required in quantities greater than a single unit, the stacking technique can be used to speed up the process and to insure that all the parts are identical. Rubber cement the part outline you traced (or cut out a 2nd RCM plan) on a single rectangular piece of wood slightly larger than the part to be cut out. Stack the same size sheets underneath in the quantity required and use straight pins to hold the stack together for cutting and sanding. Make sure that your saw blade is set at 90°. Cut out the outline of the part. Lightly sand the stack to remove the fuzz from the saw cut, remove the straight pins, and you have an instant kit. Fuselage sides, wing ribs and wing tips can be produced with the stack cutting technique. Now that you have your kit completed let's get started with construction.

#### Prior To Construction

R/C models such as the Sky Knight are most easily built on flat table tops

#### SKY KNIGHT

Designed By:

Jim Zarembski

#### TYPE AIRCRAFT

Electric Sport Trainer

#### WINGSPAN

43 Inches

#### WING CHORD

7 1/4 Inches

#### TOTAL WING AREA

335 Sq. In.

#### WING LOCATION

High Wing

#### AIRFOIL

Flat Bottom

#### WING PLANFORM

Constant Chord

#### DIHEDRAL EACH TIP

1-15/16 Inches

#### O.A. FUSELAGE LENGTH

30 Inches

#### RADIO COMPARTMENT SIZE

(L) 7" x (W) 2" x (H) 3"

#### STABILIZER SPAN

16 Inches

#### STABILIZER CHORD (incl. elev.)

4" (Avg.)

#### STABILIZER AREA

66 Sq. In.

#### STAB. AIRFOIL SECTION

Flat

#### STABILIZER LOCATION

Top Of Fuselage

#### VERTICAL FIN HEIGHT

4 3/4 Inches

#### VERTICAL FIN WIDTH (incl. rud.)

5 3/8 Inches

#### REC. MOTOR SIZE

05 Elec. w/6x4 prop

#### REC. CELLS

6

#### CAPACITY

1200 mAh

#### LANDING GEAR

Conventional

#### REC. NO. OF CHANNELS

3

#### CONTROL FUNCTIONS

Rud., Elev., Motor On-Off

#### BASIC MATERIALS USED IN CONSTRUCTION

Fuselage ..... Balsa and Ply

Wing ..... Balsa, Ply and Spruce

Empennage ..... Balsa

Wt. Ready To Fly ..... 34 Oz. (2 Lbs. 2 Oz.)

Wing Loading ..... 16 Oz./Sq. Ft.

covered with 1/2" white insulation board generally sold under the Celotex brand name at your local lumber or building supply company. If this isn't available, a 2' x 4' fiber ceiling panel will provide a good surface into which straight pins can be placed to hold the various parts of the model together during construction.

I generally use a thick cyanoacrylate for most construction. Carl Goldberg's Super Jet is the brand that I recommend. It has high viscosity compared to other super glues, it fills gaps, and it is quite light. There are some dangers in using any cyanoacrylate such as gluing your fingers together. Be sure to read the manufacturer's instructions carefully before using these products.

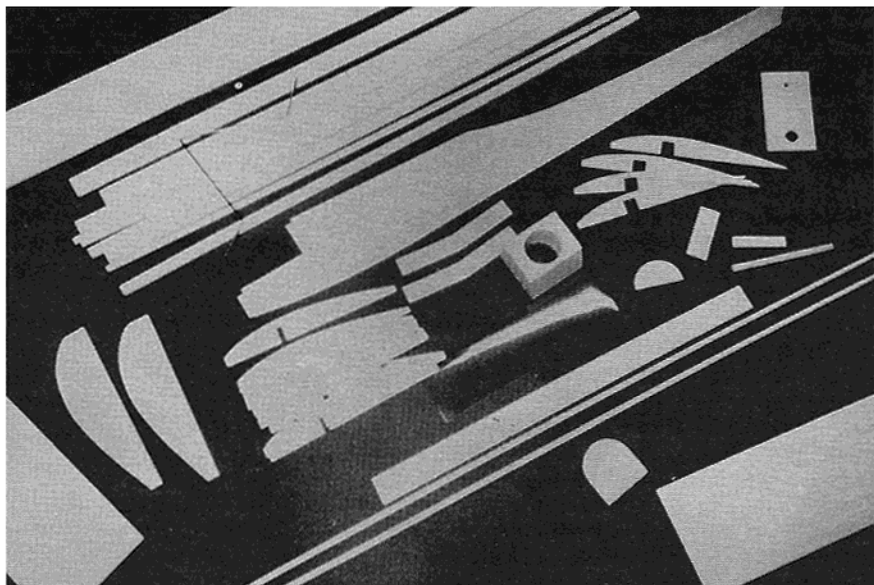
#### Fin and Rudder Construction

To get started let's begin with the simplest components: the fin and rudder which are made primarily out of 3/16" square balsa. Use a single edge razor to cut the uprights for the fin and rudder. I generally cut them 1/2" oversize top and bottom and trim to final size after assembly. Pin the uprights over the plan after you've placed a sheet of waxpaper over the blueprint. Place a 3/16" sq. stick over the assembly and eye where the cuts are to be made. Start at the bottom with the largest horizontal pieces. If you cut them too small you can use them above. When you have a clean fit, put a drop of Super Jet on each end and place it into position. You'll be amazed at how quickly the assembly is completed.

Mark the hinge locations and remove the fin and rudder from the plan. Use your X-Acto knife to cut slots in the fin and rudder for the hinges. Trim and sand the fin and rudder to a streamlined section using 220 grit sandpaper first and finishing with 400 grit and you're ready for covering.

#### Stabilizer and Elevator

The stab and elevator construction is very similar to the fin and rudder. First pin the rear 3/16" x 1/4" balsa cross member to the plan and glue the



Complete parts kit cut for the Sky Knight — good way to start.

3/16" balsa center section in place. Next, cut the leading edge for both sides of the stabilizer and pin them over the plan.

Cut and fit the stab tips and the 3/16" sq. members in place and mark the hinge locations. After trial assembling the hinges in both the stab and the elevator, sand to prepare for covering.

#### Wing

The first step in wing construction is to laminate the wing spars which are composed of 1/4" x 1/2" balsa with 1/16" x 1/4" spruce caps on the top and bottom. This gives a strong lightweight spar that can be made quite straight. Place a 36" metal rule on the building board over a piece of waxpaper and place two pins to the rear of the rule to hold it in position. Pin the 1/4" x 1/2" balsa core against the rule to make sure there are no bows. Put a bead of Super Jet on one of the capstrips and glue it into position on the balsa spar core. Remove the straightedge and glue the other capstrip in place. Repeat for the other spar half and pin both spar halves together. Mark the cut for the dihedral joint and for the wing tips and cut both spars to final shape.

Next, pin the spars over the dihedral brace shown on the plan making sure that the dihedral angle is correct. Use 5-minute epoxy to glue one of the two dihedral braces over the spar assembly. When the epoxy sets up, remove from the plan and epoxy the other dihedral brace to the other side of the spar.

Pin the trailing edge over the plan for the right wing panel along with the spar assembly. Next, cut and fit the 1/16" balsa sheeting at the wing center section. You remembered to put waxpaper over the plan, didn't you?

Next, cement the two W-1 ribs in position, angling the center W-1 to match the centerline of the dihedral brace. Be sure to notch this rib to accept the wing hold-down dowel. Cement the W-2 rib at the wing tip making sure that the trailing edge and the wing spar are aligned properly. Add the remaining W-2 ribs in place. Place a drop of Super Jet at the top of the flat front section of each wing rib and pin the 1/4" x 3/8" leading edge in place.

The next step is to remove the right wing panel from the plan and add the wing tip, W-3. You'll have to sand the edge of W-3 where it meets the W-2 rib with a sanding block to the proper angle to get a good joint.

The right wing panel is just about completed and you've probably discovered that the left wing panel isn't shown on the plan. Since the wing ribs are equally spaced, the left panel can be built over the right panel outline. The left wing tip outline is shown as a guide. Repeat all of the steps you followed on the right panel to complete the left panel.

The top sheeting at the center of the wing is 1/16" balsa with the grain running the parallel to the wing spar. In order to make the top sheeting, you'll have to splice three pieces of 3" width balsa together to yield an 8" by 3" sheet. This is simply accomplished by butt gluing the pieces together with Super Jet and sanding the sides smooth on the building board with 400 grit sandpaper mounted on a sanding block.

Before you add the center section top sheeting, make sure that you cut out the opening on the wing bottom for the hold-down dowel. Tracing paper can be placed over the wing and marked to show the curve required to get a good fit of the top sheeting at the center joint.

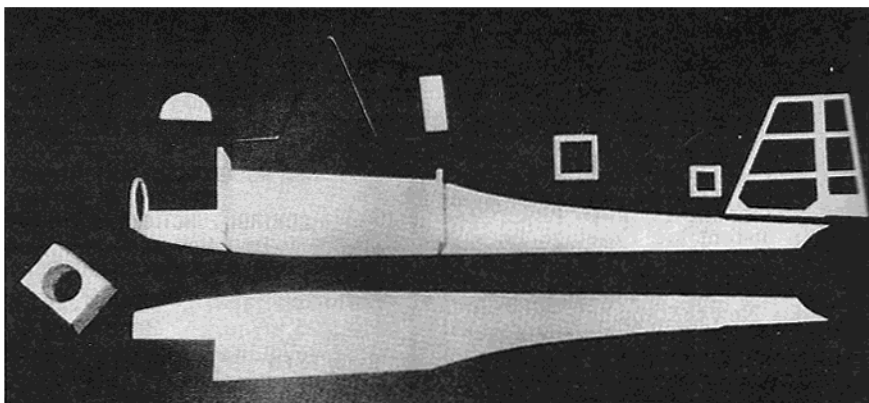
The last step is to epoxy the 3/16" wing dowel to the wing bottom. Round it slightly to assist in insertion into Former C. A 1 1/2" square of fiberglass or any cloth is then epoxied over the dowel to secure it. Similarly, a fiberglass reinforcement is epoxied to the trailing edge at the hold-down dowel location.

Use an X-Acto #26 blade to carve the leading edge to the correct airfoil shape shown on the outline for W-2. Sand the leading and trailing edge of the wing with 220 grit to the proper shape. Finally go over the entire wing with 400 grit to give a super smooth surface for the wing covering.

#### Fuselage

Start the fuselage by building formers D, E, and F from 3/16" sq. balsa. They are made this way to reduce weight and to allow cooling air to travel through the fuselage and exit at the rear of the model. Drill 1/16" holes on former C for the wire that will ultimately hold the landing gear in place.

Place the two fuselage sides together and mark the location of all of the formers on both sides. Pin the right fuselage side over the plan and epoxy formers A, B, and C in place, making sure that they are perpendicular to the fuselage side.



Fuselage partially completed. An easy project to build.

Remove the assembly from the plan and pin the left fuselage side on the building board. Place a bead of epoxy on the three formers and place the right side assembly over the left side. Use a 90° triangle to check that both sides are lined up properly. Place the triangle at the front, the top, the bottom, and especially at the top of the fuselage rear where the elevator is mounted. The triangle should just touch the two fuselage sides without any gap. If there is a gap, readjust the right fuselage side sub assembly until both sides are straight.

When this is set up, glue formers B, E, and F in place with Super Jet. Add a 1/8" x 1/4" doubler to each side at the wing mounting area and epoxy the 1/8" plywood wing hold-down strip in place. Use a pair of needle nose pliers to bind the landing gear in position and place a bead of epoxy over the wires to secure them. The top and bottom fuselage sheeting is then glued in place cross grained.

Soak a piece of 3/32" balsa in hot water for a few minutes and bend and trim it to cover the cowl top. When you have a good fit use Super Jet to hold it in position.

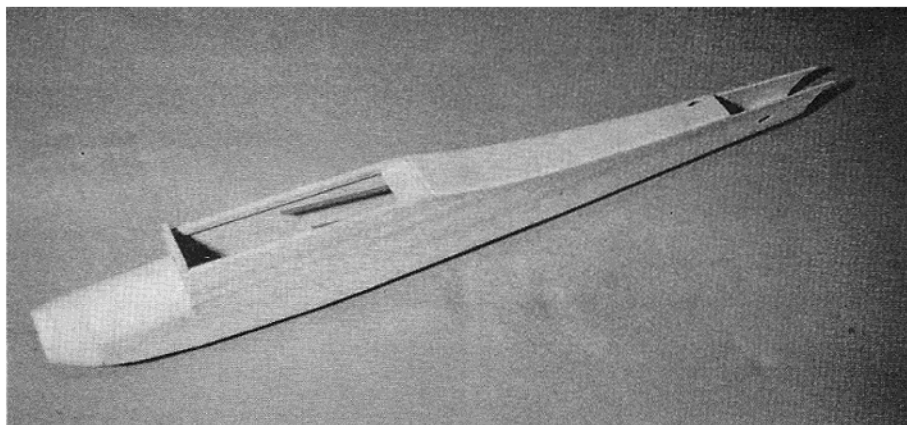
Use scrap 3/32" balsa to fabricate the cooling air intake and bottom hatch at the front bottom of the fuselage. This is held in place with a 3/32" balsa strip at the front and a single wood screw driven into a plywood or hardwood block epoxied to former C.

Glue the nose block to the front of the fuselage after you trim and sand the front. Carve the nose block to rough shape with the #26 blade. I generally place a Goldberg 1 1/2" spinner on the 05 motor and push the motor in place. Wrap the spinner with electrical tape to protect it from being scratched and finally carve and sand the nose to a streamlined shape to match the spinner.

Sand the entire fuselage with 220 and 400 grit to prepare it for covering.

#### Covering

Use a vacuum to remove loose



Completed fuselage. Note outer pushrod housings are in place.

sawdust from all of the model's components. To make sure, follow up by wiping all surfaces with a tack cloth available at a paint or hardware store to remove all debris. I recommend a lightweight covering such as Super MonoKote to cover the entire model.

The windshield can be cut from .015 butyrate and the area under the windshield can be marked using the windshield as a guide. Remove the MonoKote from this area and use black paint or ink to color this section. The windshield can be glued to the top of former C and 1/4" striping tape can be used to seal the butyrate to the cowl top and fuselage sides.

#### Final Assembly

Align the wing on the top of the fuselage and drill a 3/16" hole in the trailing edge for the wing bolt. Follow this with a 1/4" 20 tap and bolt the wing in position.

Glue the hinges in place with white glue and epoxy the fin to the top of the stab. Be sure to remove the covering from all areas where glue will be placed since epoxy doesn't stick to MonoKote.

Align the stabilizer on the fuselage making sure that everything is straight. Mark the bottom of the stab and remove the covering. Epoxy the stab in place making sure that everything is lined up properly.

#### R/C Installation

Install the control horns and your choice of control rods. Mount the rudder and elevator servos on hardwood strips. Next, servo tape the 6 cell 1200 mAh flight battery on the fuselage floor as shown. Mount the receiver with servo tape and then assemble the entire model including the motor, prop, spinner, and wheels. Next, move the R/C battery and on-off servo to achieve the balance point shown on the plan. To complete the installation, drill holes for the charging jack of the flight system and for the R/C unit's off-on switch. Finally, connect the motor to the system making sure that the switch is off.

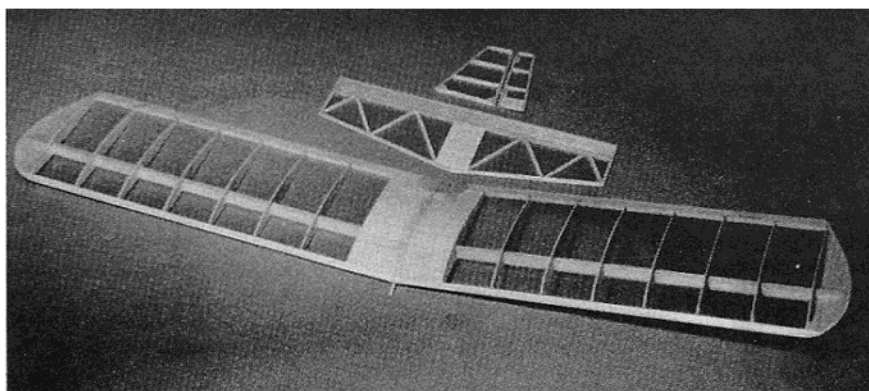
#### Flying

Charge the flight system to the manufacturer's recommendations and range check the radio with the motor off and on. Get an experienced flier to trim out the model. For training, the rudder throw should be 1/2" to each side and the elevator throw should be 1/4" up and 1/4" down. The rudder throw can be increased to 1" and the elevator throw can be increased to 3/8" for aerobatics later.

The model should be hand launched into the wind with a firm toss. This is where the experienced flier is invaluable. The Sky Knight is designed to climb with a little up trim. It cruises nicely at neutral trim and glides well with either full up or neutral trim. You'll find the Sky Knight docile and forgiving. At 34 oz. you can even thermal this ship on those lazy summer days.

In September 1985, I installed an Adam's ETC-1A Throttle Control from Adam's Electronics and learned that the Sky Knight can fly at about 1/4 throttle. I quickly learned that I could fly slow and low. On one flight I did Figure Eights at 15 feet for about five minutes. The electronic speed control really improves the flight characteristics of this model.

Good luck with your Silent Power experience. □



Completed wing and tail assembly ready for covering.