

# BOREALIS

The Borealis Bipe is the result of Leonard reading Chuck Cunningham's Basic Bipe article a few years ago. Wanting to design his own and living in Alaska where the winters are long, produced this wheel or ski equipped sport flier — great performer.

BY LEONARD L. OAKLEY



**B**iplanes have been favorites of mine ever since I was a boy in New Mexico. I can still vividly remember seeing brightly painted "double wingers" against the deep blue desert sky half filled with puffy, brilliant white, cumulus clouds. Most of the time they would just lumber noisily along obviously with some destination in mind, but occasionally a sky writer would advertise cola drinks across the sky. I also recall that biplanes usually attracted more attention from earthbound spectators than the more common Piper Cub types. Everyone would stop and stare when one flew over. I know I always did.

My father owned a couple of Standards during the barnstorming days in Kansas, long before I came on the scene. He had a couple of boxes full of photos of his "crates" which I loved to pour over for hours while wearing an old, cloth flying helmet and goggles that he had given me. I dreamed that some day I, too, would fly one of those beautiful birds. Well, I never did learn to fly for real but, through the magic of radio control, I can vicariously zoom along in my own jaunty biplane doing barrel rolls, Immelmans, loops, Split S's, and even fly inverted.

The Borealis Biplane is the result of reading a Chuck Cunningham article on basic biplane design a couple of years ago. There are lots of good biplane kits on the market and it would be easier to simply go down to the friendly hobby shop and buy one, but I get much more pleasure from designing and building from scratch. This model is not difficult to build, but I would not recommend it as a first "from scratch" project unless you have already built a number of R/C kits.

Living in Alaska, where the winters are long and snowy, forces me to use skis for a good portion of the year, or take up another hobby. This model handles equally well on snow or dry ground simply by removing four screws and changing from skis or wheels. The plans show both types of undercarriage.

Building is straightforward and should present no problems for the experienced builder. The construction sequence is up to you. However, I will present instructions in the order in which I usually build a model.

#### CONSTRUCTION

##### Fuselage:

(1) Cut the two fuselage sides from matched 1/8" medium sheet balsa.

(2) Cement the 1/4" sq. balsa vertical pieces and 3/16" balsa doublers to the balsa sides. Be sure to make one left and one right fuselage side. Models with two left sides fly (and look) funny!

(3) Add the 1/4" x 1 1/4" trailing edge stock to which the cabane struts will later be epoxied.

(4) Cut out all formers and cabane struts.

(5) Lay the right fuselage side flat on the building board and epoxy F2 and F3 in place. Check alignment with a drafting triangle or carpenter's square (exactly 90 degrees). When the glue is set, attach the left fuselage side to the formers using liberal amounts of epoxy and carefully checking alignment. It is vital that everything is straight and square at this point.

#### BOREALIS

Designed By: Leonard L. Oakley

##### TYPE AIRCRAFT

Sport Biplane

##### WINGSPAN

Top 48 1/2 Inches  
Bottom 42 Inches

##### WING CHORD

8 Inches

##### TOTAL WING AREA

685 Sq. In. (Approx.)

##### WING LOCATION

Biplane

##### AIRFOIL

Semi Symmetrical

##### WING PLANFORM

Constant Chord

##### DIHEDRAL EACH TIP

1 Inch

##### O.A. FUSELAGE LENGTH

40 Inches

##### RADIO COMPARTMENT AREA

(L)14 3/4" x (W)4" x (H)3 1/2"

##### STABILIZER SPAN

18 1/2 Inches

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

7 Inches (Avg.)

##### STABILIZER AREA

117 Sq. In. (Approx.)

##### STAB. AIRFOIL SECTION

Flat

##### STABILIZER LOCATION

Mid-Fuselage

##### VERTICAL FIN HEIGHT

6 Inches

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

7 Inches (Avg.)

##### REC. ENGINE SIZE

.35-.45 Cu. In.

##### FUEL TANK SIZE

10 Oz.

##### LANDING GEAR

Conventional

##### REC. NO. OF CHANNELS

4

##### CONTROL FUNCTIONS

Rud., Elev., Ail, Throt.

##### BASIC MATERIALS USED IN CONSTRUCTION

Fuselage .....	Balsa, Ply
Wing .....	Balsa, Ply
Empennage .....	Balsa
Wt. Ready To Fly .....	72-80 Oz.
Wing Loading .....	15-17 Oz./Sq. Ft.

(6) Drill all engine mounting holes, pushrod, and fuel line holes in F1.

(7) Add the 1/4" plywood landing gear plate and F1. Use plenty of epoxy here but wipe away any drips.

(8) Cement the rear ends of the two fuselage sides together. Check alignment

over top view of plans.

(9) Cement in place the 1/4" sq. balsa crosspieces in the rear fuselage area and add formers F3A, F4, and F5 to their top sides as shown.

(10) Cement the 3/16" sq. balsa stringers in place on top of formers F3A-F5.

(11) Add formers D1 and D2.

(12) Epoxy both cabane struts in place. Be sure that each strut is cut to the length shown and that the bottom edge of the struts are even with the lower edge of the trailing edge stock. Accurate cutting and placement here is vital if proper incidence angles are to be achieved.

(13) Add 3/32" x 3/8" balsa planking between D1 and F3. When all pieces are in place and the glue is dry, set the cockpit pattern in place and trace around the edges. With a very sharp model knife, cut out the cockpit.

(14) Add the 1/8" sq. balsa strip to the inside rear of the cockpit.

(15) Cement the 3/32" sheet balsa cockpit floor in place.

(16) Cement the 3/8" balsa wedge to F1.

(17) Pin formers H1, H2, and H3 in place on top of the fuselage sides and add the 3/32" x 3/8" balsa planking to complete the fuel and battery compartment hatch.

(18) Assemble and attach the hatch latch and canopy peg as shown. Be sure to Hot Stuff the 1/16" music wire lever in place **before** inserting the sanded 3/16" dowel into the brass tube.

(19) Build the cowl from medium soft balsa blocks as shown. Carve and sand to smooth contours.

(20) Add the 3/32" sheet balsa fuselage bottom planking, crossgrain.

(21) Add the 1/4" dowel wing rubber hold-downs.

(22) Build the steerable tail wheel assembly. Do not attach to the fuselage until you are attaching the rudder.

##### Empennage:

(1) Cut the horizontal stabilizer and elevator from 1/4" sheet balsa. Mark the centerline on top of the stabilizer to aid in proper alignment when attaching to fuselage.

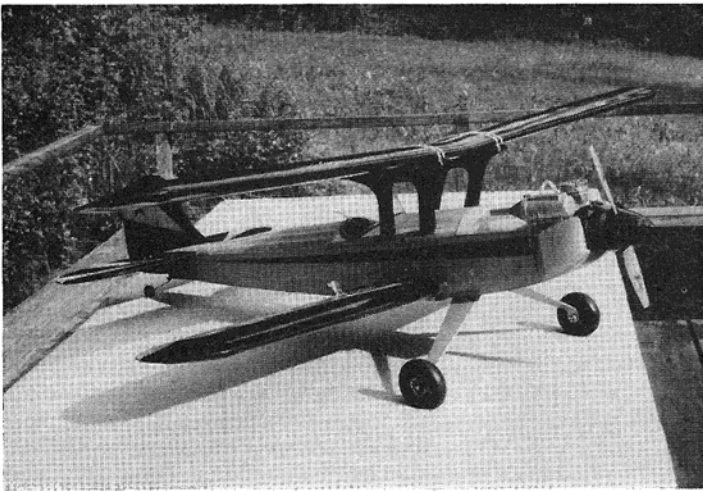
(2) Cement the stab securely to the fuselage and add the triangular 1/4" sheet balsa filler to the top of the stab. This piece conforms to the top view shape of the rear of the fuselage.

(3) Pin the elevator halves in place over the plans. Epoxy the 1/4" dowel joiner in place. When dry, remove from plans and fill in any depressions in the joiner-elevator region with "blunder putty" (plastic balsa).

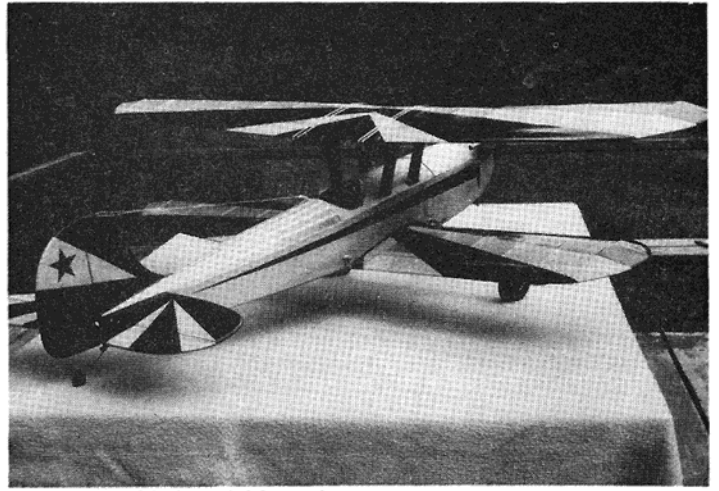
(4) Cut the two fin pieces from 1/4" balsa and cement together over the plans.

(5) Cut the rudder from light 1/4" sheet balsa. Add the two 1/32" plywood doublers.

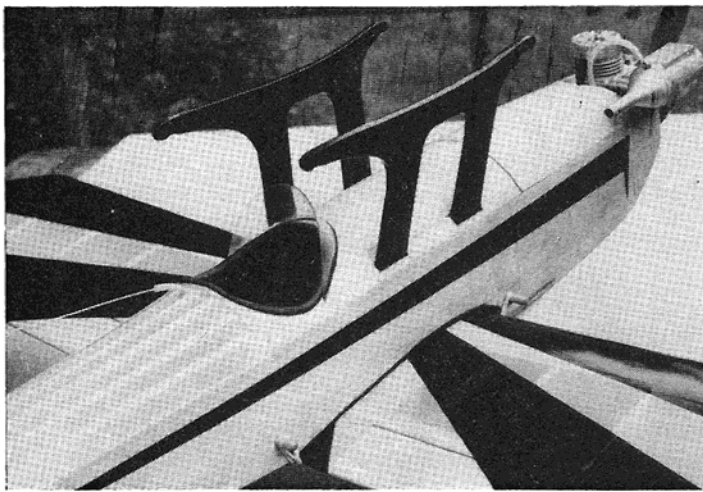
(6) Cement the fin securely to the 1/4" balsa filler you previously glued to the top of



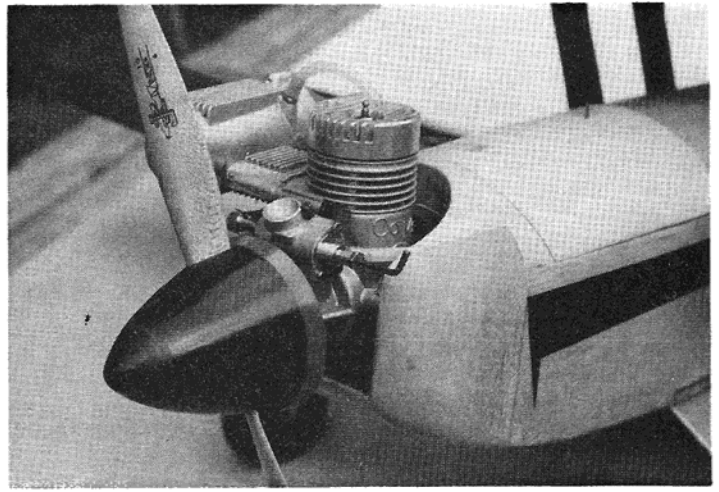
*Fully assembled model from the front.*



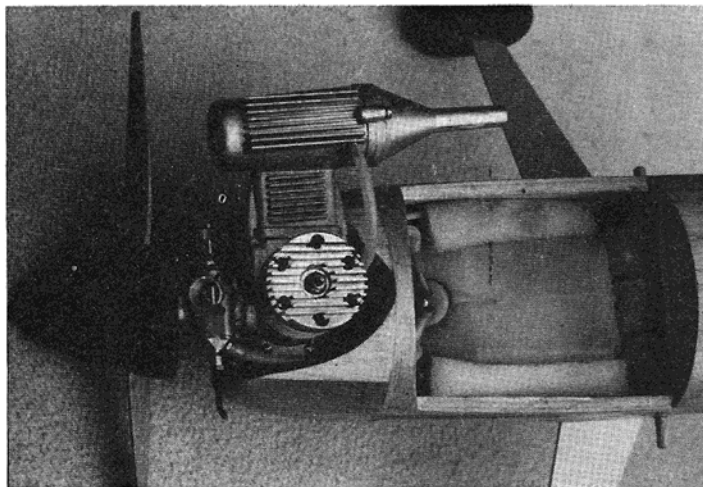
*Fully assembled model from the rear.*



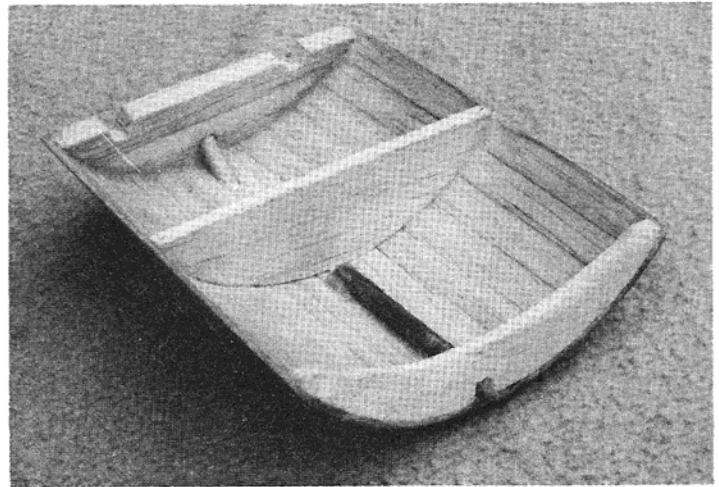
*Top wing removed to show cabane struts.*



*Up front is a Como .40 swinging a Zinger 10/6 prop. Nice combination.*



*Hatch removed showing "pylon" 10 oz. tank.*



*Underside of tank hatch. Hatch was planked with strips.*

the stab.

(7) Add the balsa block fairings to each side of the fin and sand to shape. It is probably better to shape the fairing blocks about 90% before cementing in place.

(8) Radius the leading and trailing edges

of all surfaces, as shown on the plan sheet.

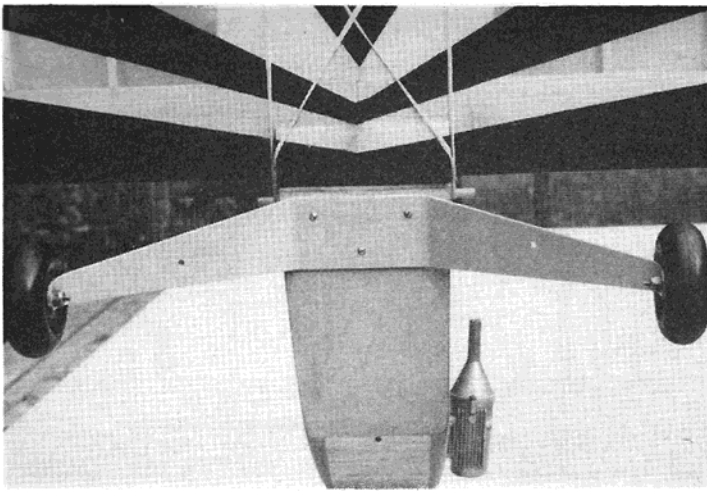
**Wing:**

(1) Using carbon paper, very carefully trace the wing rib patterns onto 1/16" plywood. These will serve as templates for cutting all ribs. The ribs may be cut

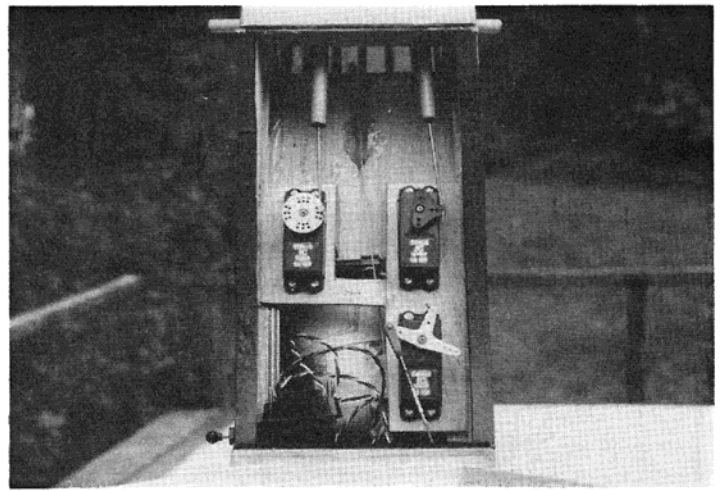
individually or, if you prefer, can be stack carved.

(2) Pin down the lower trailing edge sheeting of the upper wing directly over the plans.

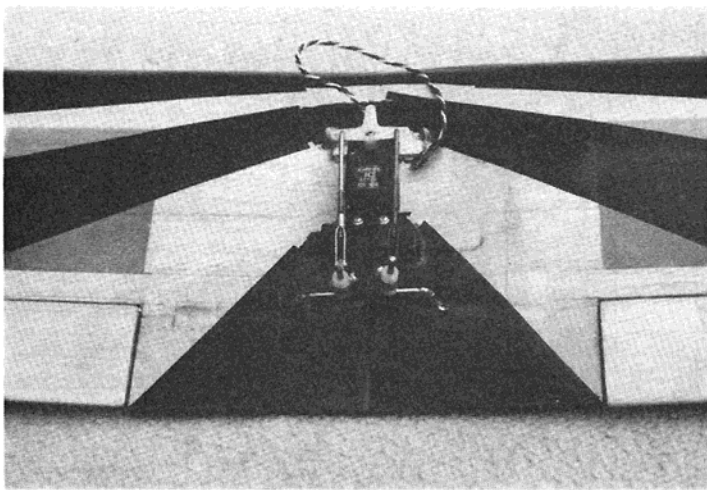
(3) Place 1/16" shims about half chord



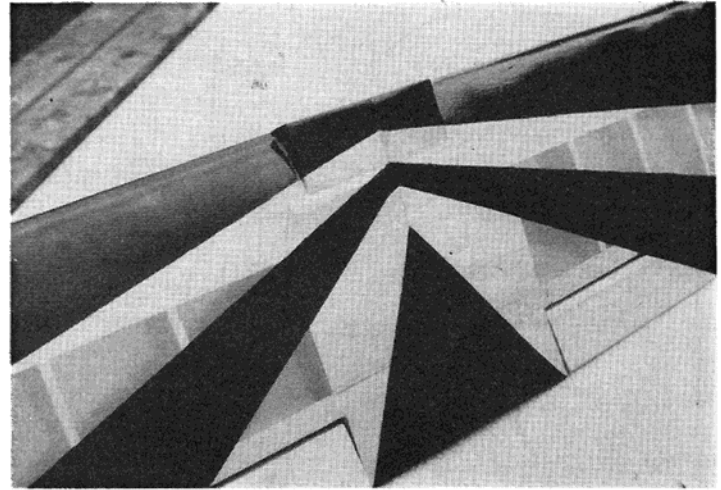
Bottom side showing landing gear installation. L/G bolted to 1/4" ply plate.



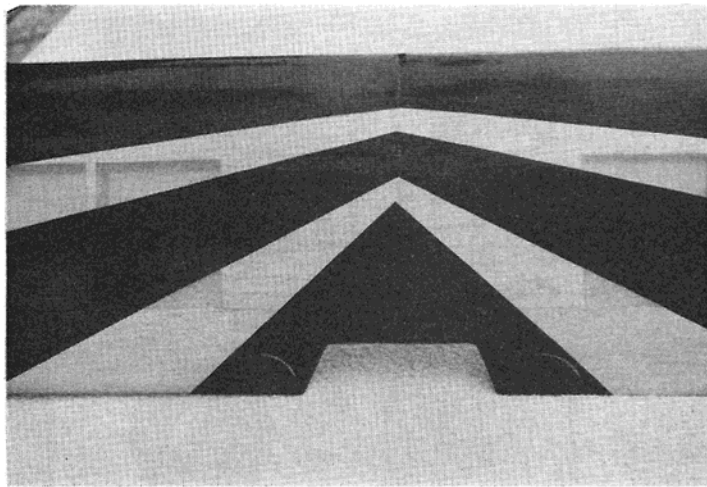
Bottom wing removed showing ample room for servo installation and access to linkage.



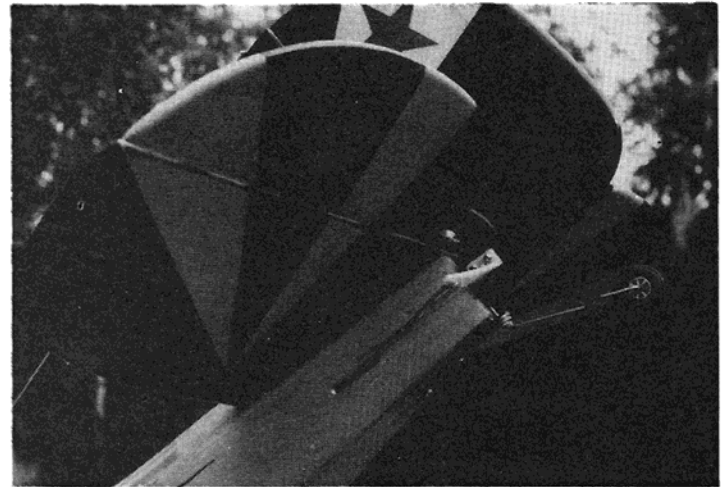
Aileron servo installed in bottom wing.



Note fairing block on leading edge to match fuselage bottom.



Center section of top wing. Note 1/32" ply reinforcements where bands go.



Shows rudder horn and linkage. Elevator horn on right side.

under each rib.

(4) Cement all ribs in place (except center line pair which are not cemented until the wing halves are joined) onto the trailing edge.

(5) Add both top spars. Cement securely.

(6) Add top trailing edge sheeting.

(7) Cement 3/8" sq. leading edge in place.

(8) Pin down W1, W2, and W3 tip pieces directly over the plans and cement together. Do not cement tips to wing panels yet.

(9) Remove the wing panels from plans and add lower spars and lower leading edge sheeting.

(10) Cement tips to main panels. Note that the front edge of each tip is cemented directly to the 3/8" sq. leading edge.

(11) Pin the wing panels back to the plans and add the 1/8" shear webs. A good fit here is important to the overall strength of the wing.

(12) Join the upper wing halves by epoxying the 1/4" plywood dihedral brace between the main spars.

(13) With one wing half flat on the table, block up the other half 2" (measured at underside of **tip rib** behind main spar).

(14) Cut the two center ribs in two between main spar notches. Fit in place and cement.

(15) Add leading edge sheeting and upper and lower center section sheeting.

(16) Cement 1/32" plywood half circles to the upper side of trailing edge. These help prevent the rubberbands from cutting into the wing.

(17) The lower wing is built similarly to the upper wing except that the ailerons must also be built. If you successfully completed the upper wing, close attention to the plans will get you through the lower wing.

#### **Covering and Finishing:**

The original models were covered with silk and dope but at least one was covered with plastic film. I prefer silk and dope not only because it adds realism but it also greatly increases rigidity. However, any modern covering method will be adequate so use your favorite kind. Be creative!

#### **Flying:**

The model has been flown with both .35 and .40 size engines. The .35 is adequate but naturally it is more aerobatic with a .40. Be sure it balances within 1/4" of where shown on the plans. Hold a little right rudder on the take-off run and allow the model to build up sufficient speed. A slight amount of up elevator will lift the model into the air. You are now on your own. Have a ball!

I would be interested in how your model turns out. Or, if you have building or flying troubles, please write to Leonard L. Oakley, Box 216, Chugiak, Alaska 99567.

## **Editing By Hlsat. RCModeler July 1981.**