Bill Noonan

Sopwith Dolphin

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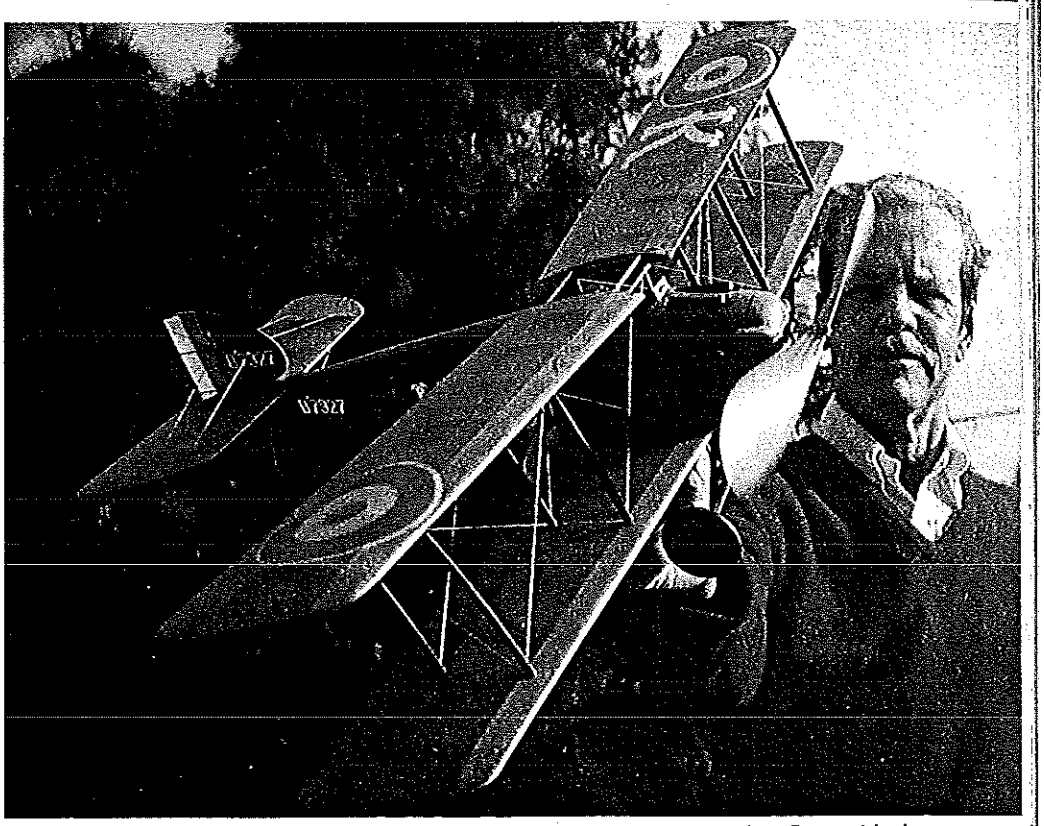
The master of Free Flight Scale shares with us another of his delightful rubber-powered creations. This one, with 3/4-in. equals 1-ft. scale, has some aerodynamic gymnastics which allows the biplane configuration to act as a high-wing monoplane insofar as balance is concerned.



Held by the author, the Sopwith Dolphin is shown off to good advantage in this view. Symmetrical airfoil of bottom wing doesn't show from most angles. Surprisingly, model requires 2° upthrust.

THE SOPWITH DOLPHIN, contrary to popular belief, was an excellent aircraft. Only after installation of the 300-hp Hispano-Suiza engine, in lieu of the unreliable 200-hp version, did the Dolphin prove itself as a combat weapon. Unfortunately, this came in the closing months of 1918, too late for the airplane to demonstrate its full capabilities. Its performance was superior to any other aircraft in service in November of 1918.

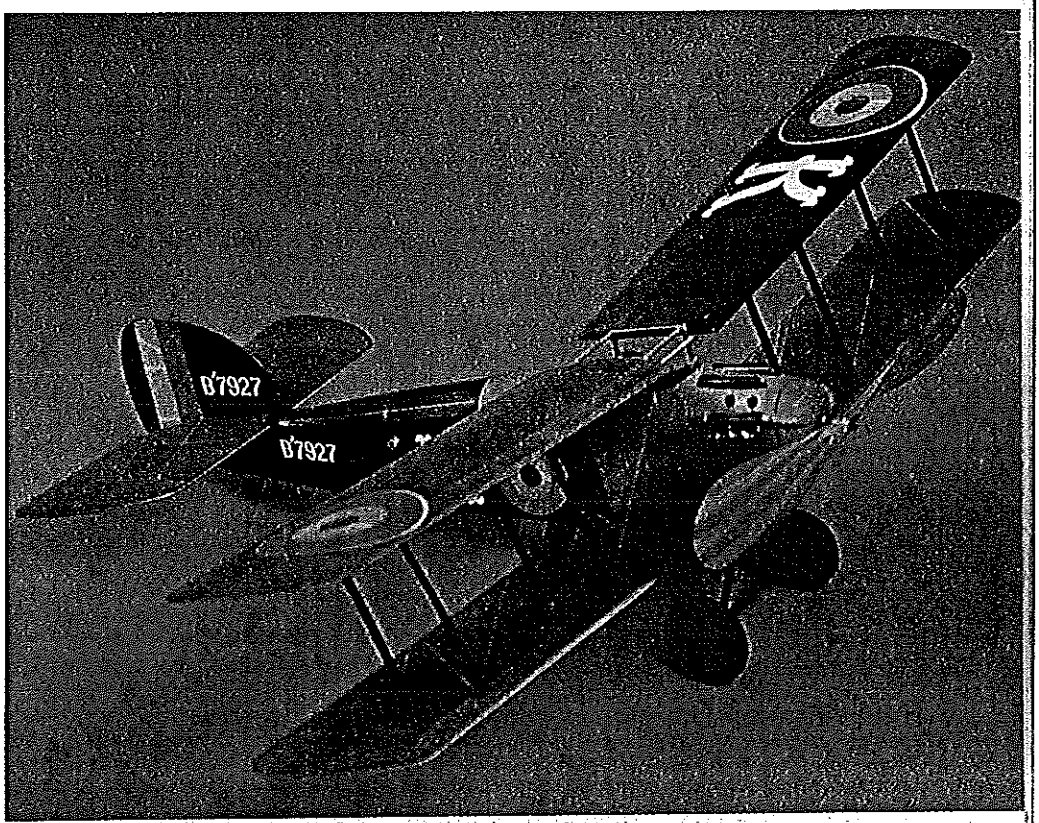
The Dolphin configuration suggests that its designer, Herbert Smith, hoped to achieve a high degree of maneuverability by repeating lessons learned on the famous Camel: close grouping of engine, armament, fuel tanks and pilot into the most compact mass. Along with this, Smith took a somewhat unorthodox design route to assure the pilot of optimum upper visibility, of primary tactical advantage in aerial combat.

The pilot sat framed in the middle of an opening in the center of the top wing, which was positioned low above the fuselage. The center of gravity (CG) and lift arrangements dictated that the lower wing be ahead of the upper, creating negative stagger, a Dolphin design distinction.

The Sopwith Dolphin provides the basis for an interesting modeling subject; it possesses good proportions, and it is well-documented photographically for those who like to incorporate all the details. The only drawback, you might say, is the short nose. This can be detrimental to flight duration in rubber models, as it requires excessive ballast to bring the CG to its correct position.

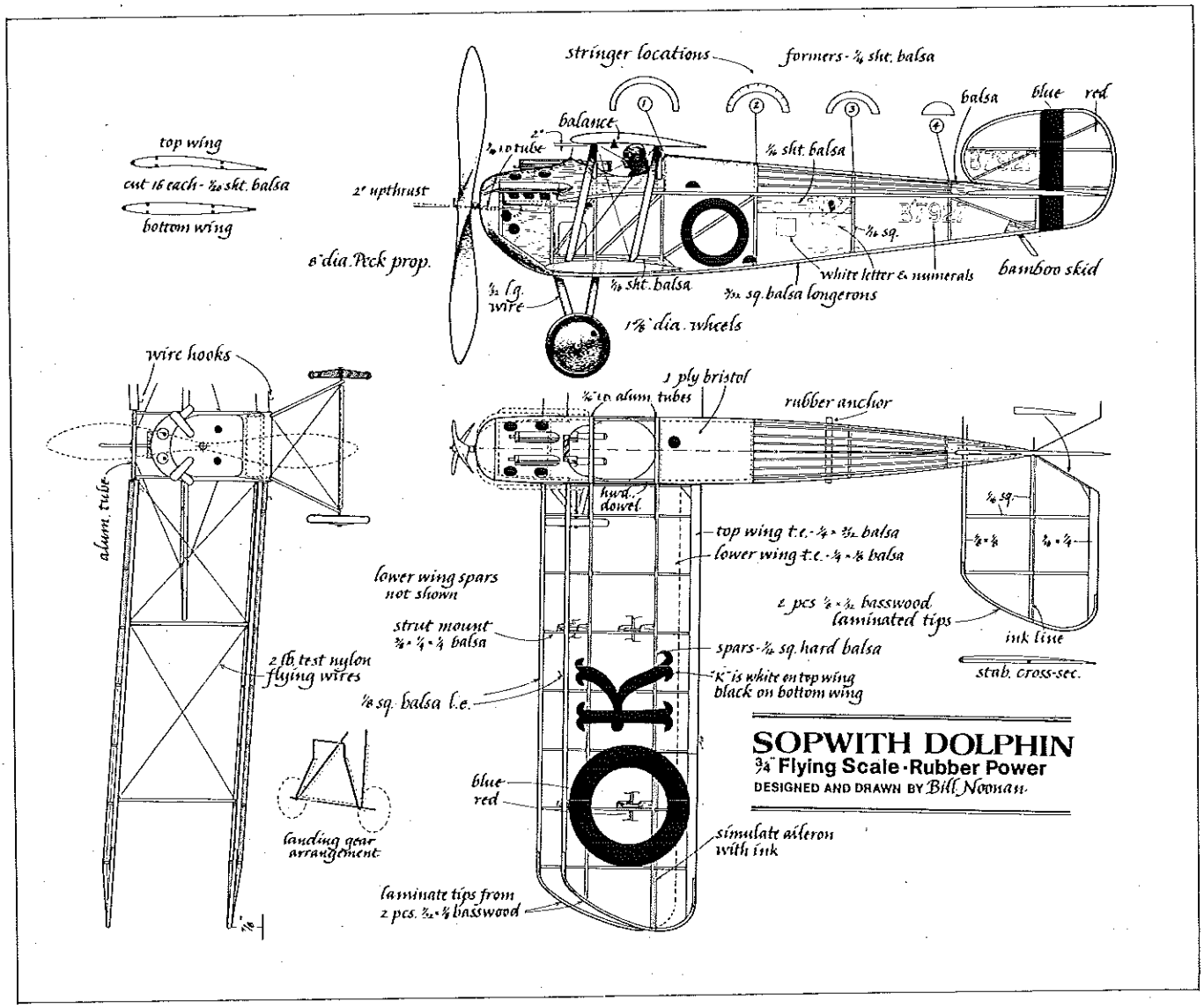
We decided to try an idea to alleviate this shortcoming. If you look at the Dolphin as if it were a parasol monoplane, the wing is in just about a perfect location. The generous area of the top wing is quite adequate in terms of potential lift. Why not give the bottom wing a streamlined (non-lifting) airfoil? It will then just go along for the ride, and in doing so, allow the

Ah, those gorgeous lines of a biplane. To keep model light, for good flying, it was covered with white tissue and colored with dye from a spray can—from art supply stores. Fuselage and tops of wing/stab are olive drab, cream bottoms.



Author recommends Peck-Polymers prop—8-in. dia. if takeoffs are planned, 9-in. for better performance if hand-launching. Uses four or six strands of 3/16-in. rubber for power.

FULL-SIZE PLANS AVAILABLE . . . SEE PAGE 140



CG to be related to the upper, rearward wing.

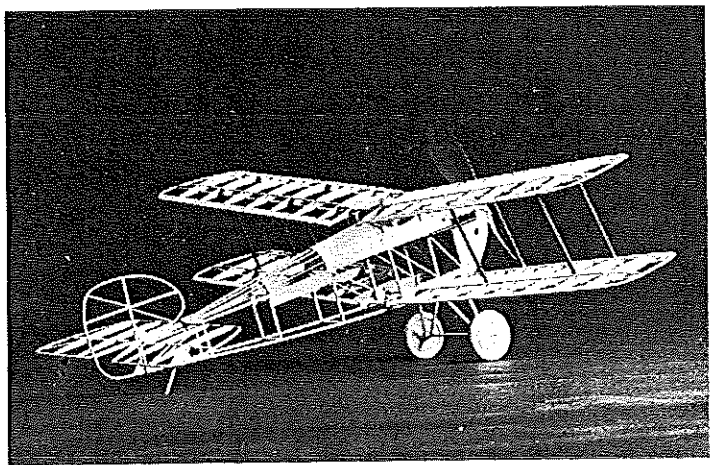
This works remarkably well. The model needs no additional weight in the nose, and best of all, it is absolutely stable—with spectacular windy weather penetration. One of the peculiar requirements is the need for 2° upthrust. Most Scale models require just the opposite.

The Dolphin is easy to build, and the end result is a model with a lot of character. Our primary source for information was the old Profile Series, Number 169. The squadron markings shown in that publication give the builder a choice of about eight different schemes.

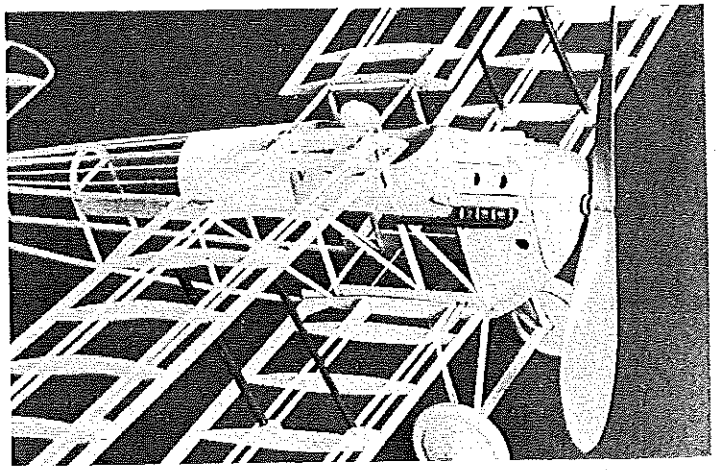
Fuselage construction. Before starting any construction, it is well to protect the plans from surplus cement by overlaying them with wax paper or Saran Wrap.

Lay 3/32 sq. medium balsa longerons over the side view. Do not pin through balsa. Carefully cut and set in 1/16 sq. uprights and diagonals. The uprights at either end of the longerons are 3/32 sq. Make a right and a left side in this manner, keeping the 1/16 material "inside" the 3/32 longerons. This makes for a better looking covering job later on.

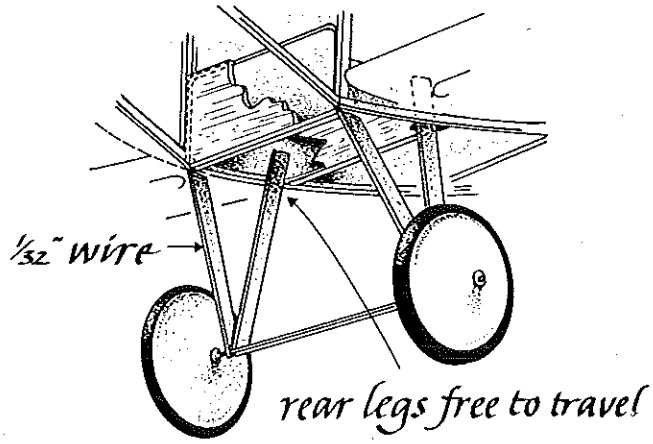
After cement is thoroughly dry, remove the sides, and fit the widest cross-members (1/16 sq.) which are in the cockpit area. After cementing these, pinch the nose and tail. Note that the nose has a slight taper. Cement tail post, and add nose cross pieces, holding together with spring clips or lightweight adjustable clamps. Fill in other cross



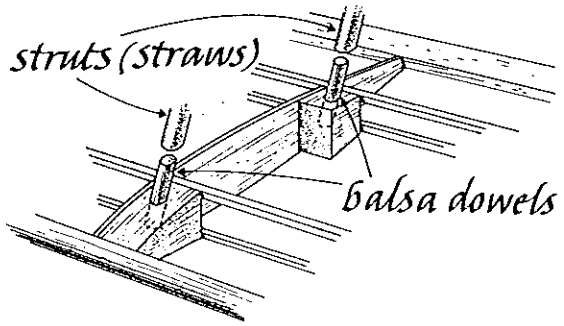
Uncovered structure is beautiful. Model is large enough so that wood sizes aren't ultra-delicate. Interplane struts are cocktail straws.



Pilot figure, machine guns, exhaust stacks, turned wheels all enhance the model's looks, don't weigh much, can be added fairly easy.



LANDING GEAR ARRANGEMENT



INTERPLANE STRUT MOUNTS

pieces.

Add 1/16 sheet lower wing root filler, and also filler pieces to accommodate rubber anchor tubing. See position on plans.

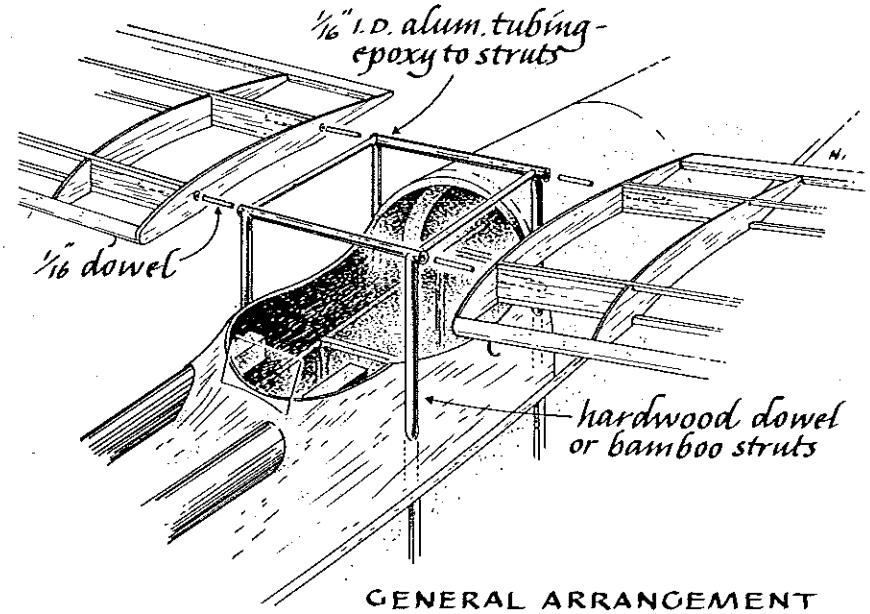
Cut turtleback formers from light 1/16 sheet balsa. Cement in place, and file stringer notches with small file or folded sandpaper. Stringers may be sliced 3/32 x 1/32 hard balsa or similar size basswood (available from model railroad shops). The basswood has the advantage of not sagging between formers. Note that stringers run from bulkhead 2 to 4, with 1-ply bristol (card stock) covering the turtleback immediately behind the cockpit (to simulate metal covering as found on the real machine).

The sculptured cowling surrounding the cockpit and engine portion is carved from soft balsa block, and hollowed out to about ⅛-in. wall thickness. This component requires some care to fit accurately, as it has to be drilled to accept bamboo cabane struts, gun cavities, and circular vent holes. The opening immediately below the valve cover projection may be cut, or painted flat black later.

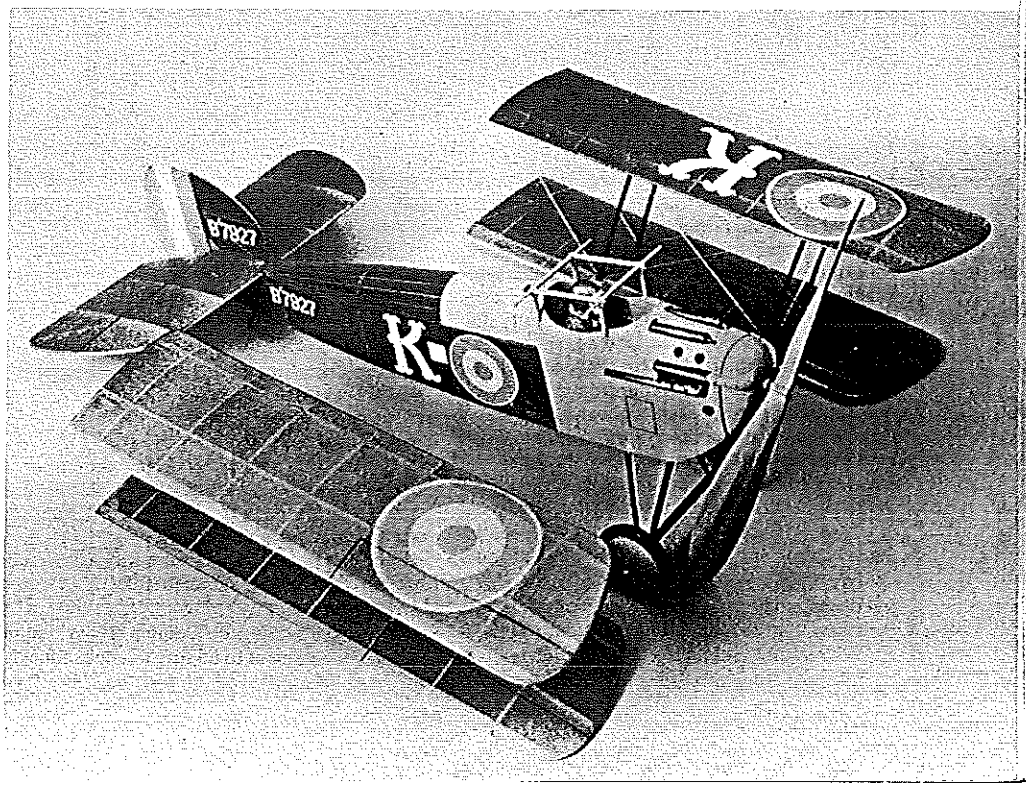
The sides of the nose are filled with 1/16 sheet balsa, the bottom "chin" is ⅜ soft balsa, slightly rounded forward of the landing gear struts. Cut nose block from hard balsa block or laminate from ¼ sheet balsa. Fit 1/16-in. inside diameter (ID) aluminum tubing or nylon thrust button for prop shaft, which should be .045-in. wire. Incorporate 2° upthrust, as mentioned earlier.

Exhaust pipes may be made of soda straws, or fashioned from balsa. Valve cover and fairings are balsa. The two Vickers guns are made by wrapping paper around a dowel, and cementing at the seam. After removing from dowel, fill the front end with a small balsa disc, and add a short muzzle. All of these details should be given at least two coats of sanding sealer before final coloring is applied.

The landing gear is bent from 1/32-in. wire. See sketch for general arrangement. The spreader bar is soldered in the crotch of the Vs. Note that the front legs are cemented to a 1/16 sheet cross piece inside the fuselage, and the rear legs are free to travel through holes provided in the fuselage bottom. This allows the spring wire to absorb impact shock without transmitting stress to structural members. Fill fuselage bottom with 1/20 sheet balsa in cockpit area. Add streamlined balsa fairings to landing gear legs and axle.



GENERAL ARRANGEMENT
CABANE STRUTS



Finished models with wings removed. Rigging is 2-lb.-test nylon fishing leader—not only adds to the appearance, but also provides rigidity. With planning, one continuous piece does each set.

Author launches the model for early morning sortie. Noonan says this is one of the few models he has flown in which he feels absolute confidence in what it is going to do—a predictable flier, and it is rugged. This picture by David Noonan, others by the author.

Turn wheels from medium balsa, using a small lathe if you have one, or by chucking the rough wheel disc in a drill motor. This may be done by cementing a ¼-in. hardwood dowel about 1 in. long in the center of the balsa disc, this becoming the piece to be placed in the chuck. After contouring the tire and wheel with various grades of sandpaper, cut the dowel off flush with the wheel sides, and drill a 1/32-in. hole for the axle.

The tail skid is fashioned from a bamboo sliver which is set in a scrap balsa block and cemented at the tail post.

On our model, we made the wings removable, retained with rubberbands, to absorb impact shock. The weight penalty is very slight. The four wing panels are provided with 1/16-in. ID aluminum tubing cemented at root ribs and running parallel with spar sides. These tubes mate with similar tubing cemented transversely across the fuselage, two supported by cabane struts, and two across the cockpit bottom for the lower wings. Hardwood dowel of 1/16-in. dia. and about 1 in. long is forced into each of the eight tube ends, forming a "plug-in" capability. In the case of broken dowels, they may be easily replaced by pushing the broken parts out of the tubing. Allow for dihedral when cementing tubing in place.

Wing construction. Cut 32 ribs from 1/20 medium balsa, 16 of which are for the top wing, 16 for the bottom (streamlined) wing. Pin each batch together, and sand carefully to assure uniformity and airfoil accuracy. Scribe spar locations with sharp, soft pencil, making sure that these are 90° from rib chord. Carefully file notches to receive the four 1/16 sq. spars.

The ribs are vulnerable to breakage at the little web that separates the top spar from the bottom. After removing the pins, an application of cyanoacrylate glue (such as Hot Stuff) to this web of individual ribs greatly strengthens the balsa.

Assemble the ribs over the plans, fitting them to the two lower spars. Carefully force top spars in place. Position leading and trailing edges in place. Check the assembly for alignment, and apply cyanoacrylate glue to joints.

It doesn't make any difference which wings are built first, but be sure that root ribs are slightly angled on the lower panels to accommodate dihedral. All four wing panels have hard balsa filler pieces cemented between the top and bottom spars from the root rib to the second rib. This contributes to strength where the wing is most vulnerable, and also forms a base for the aluminum tubing "plug-in."

The wing tips are made by laminating two pieces of 1/32 x ⅛ basswood (which has been soaked in hot water) around thick (⅛-in.) cardboard or balsa forms which have been cut to the tip contour. Wax edges of the form with a common household candle or a child's crayon before applying white glue to the basswood, which then is held in place overnight with pins. The white glue tends to seep out from between the laminations, and the waxing facilitates removal of the tip part from the form.

After tip is thoroughly dry, trim as shown, and cement in place. Pinch the top and bottom 1/16 sq. spars where they butt the tips. Apply cyanoacrylate glue. Cement the 16 interplane strut bases in place, noting that they should position on the top surface of the bottom wing and on the bottom surface of the top wing (got that?). Later on, after the covering has been applied, these are drilled to accept ⅛-in. balsa dowels about ¼-in. long, which become the straw interplane strut mounts.

Carefully contour leading and trailing edges to conform to airfoil, fairing in basswood tips. All frame members should be finished with 400-grit sandpaper.

Tail surfaces. The stabilizer is constructed by laying hard 1/16 sq. balsa over the plans where spars and ribs are located. Position ⅛ sq. and 1/16 x ¼ balsa leading and trailing edges in place. Apply cyanoacrylate glue to all joints. The 1/16-in. "ribs" are built up by applying 1/16 x 3/32 pieces (glued on the 1/16 edge) running full chord, from leading to trailing edge. These pieces are trimmed to give a lifting airfoil, and they also strengthen the framework where the structure abuts the spar. Tips are laminated in the same manner as the wing tips. See typical stabilizer cross section on plans.

Build the rudder in the same way as the stab, but make the airfoil symmetrical.

Finishing. Covering the Dolphin is easy, requiring only a comment to be sure to apply adhesive to the undercamber of the top wing. We favor using diluted white glue to adhere the white tissue to the frame, but you may prefer clear dope or something else. Use whatever provides you with the best results.

The color scheme of the Dolphin followed the prevailing British practice of 1918—olive drab fuselage and top surfaces of wings and stab, cream undersides to the entire aircraft. On some Dolphins, the metal portion of the turtleback and the fuselage forward of the cabane struts were painted light gray as were the wheels. Identifying letters and numerals were white, with the exception of the "K" on the underside of the lower right wing, which was black. The rudder was striped red, white and blue, with the blue stripe being the one closest to the fin.

After covering the model, shrink the tissue with a fine spray of rubbing alcohol. This evaporates much more rapidly than water, and minimizes the possibility of loosened glue joints.

We colored our model with "Spray Mark," an aerosol dye available through better stocked art supply stores. It has the advantage of being transparent and very light. It has excellent resistance to fading. Its main shortcoming is that it is water-soluble and requires at least two coats of clear dope to effectively seal it.

The areas on the model where the roundels are shown were masked with "frisket," a thin translucent vinyl-like material with an adhesive back. This also is available through art supply stores. The roundels, as well as the rudder stripes, were cut from colored tissue and doped onto the white tissue.

The interplane struts are made of strong, light, cocktail straws, painted gray. These fit down over the little balsa dowels described earlier. Because most straws are polyethelene plastic, they resist most glues or cements. It helps to take a small rat-tailed file and roughen the insides of the straw before using (preferably) epoxy. Flatten slightly to a streamlined section.

Although it looks somewhat complex, rigging is really quite simple. Thread 2-lb.-test nylon fishing leader in a small needle, and proceed to stitch the rigging in place, piercing the straw strut bases. With care and planning, one continuous piece of thread can be used for each set of wings. The rigging not only lends character to the model, but contributes a great deal to unifying the wing assemblies.

If you use the removable wing feature, be sure to install small hooks at leading and trailing portions of both top and bottom wings so rubberbands can hold the wings in place. These stretch between the top panels approximately at the spars, and under the cockpit on the lower wings.

Finish detailing the model with ink-ruled lines for ailerons, rudder and stabilizer separations.

Flying. If you intend to let the Dolphin take off of the ground (ROG), use the 8-in. Peck-Polymers prop, but a 9-in. gives significantly better performance. Power the model with four (lubed) strands of 3/16-in. rubber for pleasant, no-trauma flights. Six strands really gets her up there, but makes adjustment a little more critical. Rubber should measure about twice the length of the distance from the aluminum tube to the nose. You should be able to pack in at least 1,600 turns with the four-strand motor.

The Dolphin is one of the few models I have flown where I feel absolute confidence in what it is going to do when I release it. It is a predictable flier, and the structure is able to take a lot of abuse. If you are looking for a World War I subject that isn't often modeled, the Sopwith Dolphin has a lot to offer.

Safe Flying Is No Accident!

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