



PHOTOGRAPHY: HANS HOCHRADEL AND BOB HUNT

# Combo

By Hans Hochradel

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Features from many outstanding biplane designs are to be found in this nimble handling ship.

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**T**he reason for designing and building Combo was that it was hard to find what I wanted in existing designs. Combo is a combination of the best of several biplanes. Many aspects of appearance, design and construction reflect the leading biplanes currently on the market. Combo's closest cousin is the Smith Miniplane by Sig Manufacturing. This model is *not* a Miniplane. It may look like a Miniplane and have some parts and building similarities but that's it. A quick review of the technical data for Combo and the specifications for the Miniplane will show a great deal of difference. The flying characteristics are also completely different. Combo has clean simple lines of design. This philosophy follows in the building and flying characteristics.

A list of unique features of Combo follows: 1.) Six 1/4-20 nylon bolts hold down both wings; 2.) Du-Bro ball link snaps to hold the interplane struts; 3.) Sig Smith Miniplane Cowling; 4.) Hidden Semco Pitt's style muffler; 5.) Bridi dural aluminum landing gear with Gee Bee wheel pants; 6.) One piece aluminum sheet cabane struts (no wires); 7.) Robert's Super Fueler; 8.) C.B. Associate tail wheel assembly.

This model is for the average flyer, and above average builder. If you've mastered take-offs and landings, but are having trouble with three consecutive rolls your flying ability is more than adequate. If you enjoy building models that look like full size aircraft and not a cross between Star Wars and high speed freight trains this is the model for you. Building this model is not for the rank novice builder. You should have a few successful trainers under your belt and be familiar with building terminology and procedures. If you hear yourself saying "no matter how many times I cut this piece, it's still too small," this is not the model for you.

For all hot shot pilots reading this, yes a .60 size engine will fit under the cowling, and the airframe is strong enough to handle the stress. However, believe me, a good .40 size engine has more than enough power. Remember, "scale" flying speed is a desirable element in a model. If you want a biplane bullet,

this is not the model for you.

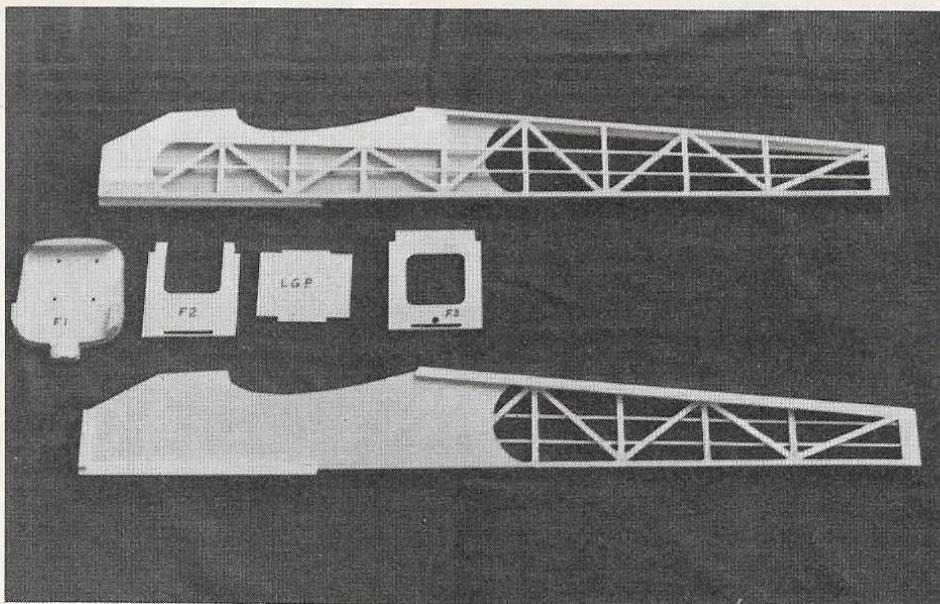
A word about acrobatics and crowd pleasing flying on Sunday afternoons may be in order. This model is definitely a crowd pleaser in looks and acrobatic ability. However, this model flies what is known as lite acrobatics. The master of this type of flying is Duane Cole of Texas. He flies a full-scale Taylor craft through some beautiful acrobatics. This type of acrobatics lacks vertical maneuvers, outside maneuvers, and tight maneuvers. So, you ask, what's left? (Or, what's so great about lite acrobatics?) Beautiful stall turns, diving for speed for nice round slow loops, unbelievable barrel rolls, and spins (like you see at airshows) are what's left. This is not a pattern aircraft, but it is crowd pleasing, realistic looking, and an easy flying biplane.

The prototype weighed just under six pounds, and with wheel pants on rough grass and no wind took-off in about 25 feet. Flying speed was about 35 miles per hour. This biplane flies like a trainer and landings are a pleasure. Being critical and listing the complaints of other flyers who have flown Combo, the elevator is slightly too sensitive and the ailerons are not sensitive enough.

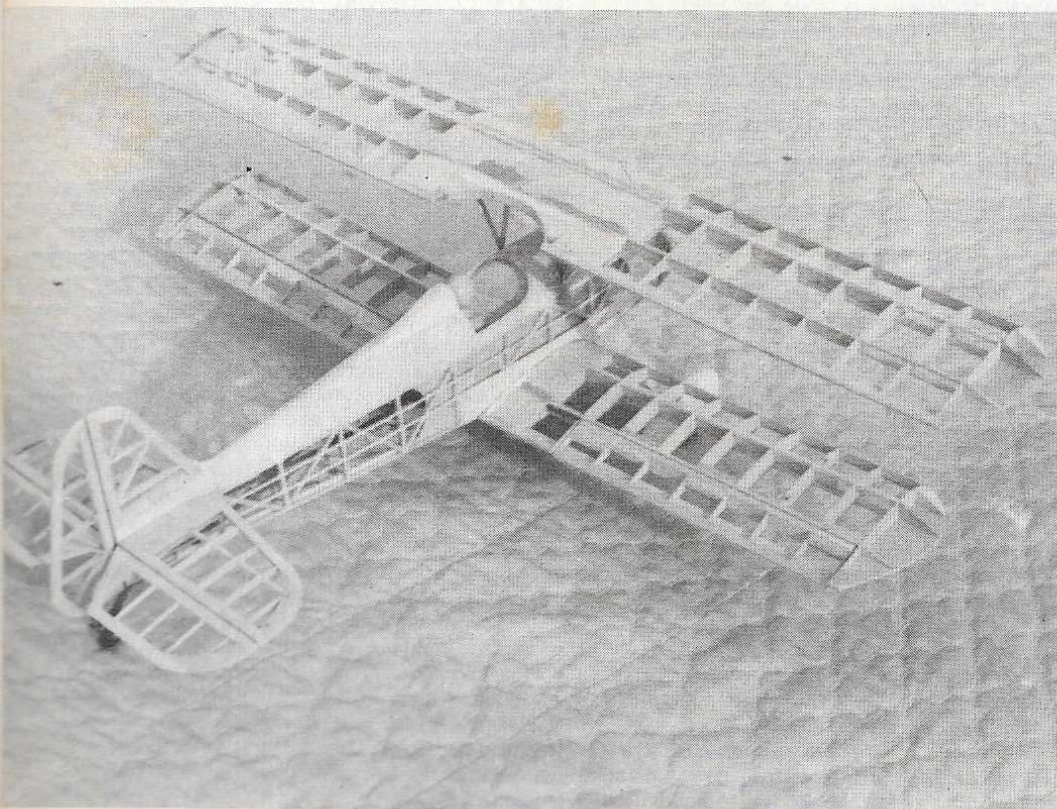
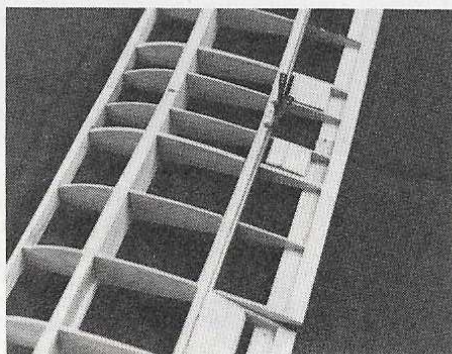
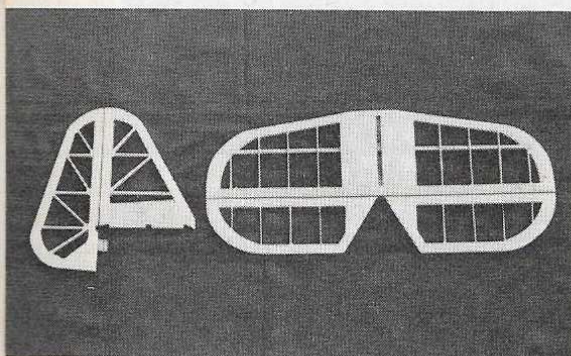
To sum up beginners will be able to fly Combo, but should not attempt to build Combo. Some previous building experience is warranted, especially in a scratch built model that is a biplane. If you have read this far in this article you are the type of modeler that is willing to put the time and effort into a project like this and obtain all the rewards. Not the least of which is having a model beautifully different than the others at your flying field and one with crowd pleasing acrobatic ability.

## Construction

Construction of the model follows established proven building procedures and tech-



Completed fuselage sides with formers ready for gluing (above). Outside surface at top, inside at bottom. Tail surfaces ready to be glued to fuselage (below left). Note hinge at lower portion of rudder which attaches to fuse. Bottom wing under construction (below right). Note control horns and trailing edge.



Combo airframe finished, awaiting covering. Note the size of the ailerons. Despite their size, plane is not overly sensitive. Even though it is not scale, the Combo looks like a real, full size biplane. Pretty.

niques. Therefore, this portion of the article will not be a step by step description of how to build a Combo. For the most part the steps are obvious if this is other than your first or second building attempt. This phase of the article will concentrate on the procedures and techniques unique to Combo and also cover in detail the features built into the design.

### Wing

Using  $\frac{1}{16}$ " balsa, cut out all the wing ribs as per the plans. Remember, some ribs are smaller under the center wing sheeting. The main spans are  $\frac{1}{4}$ " spruce with end grain  $\frac{1}{16}$ " balsa webs. This is similar to model sailplane construction. The webs start bear the end of the plywood doublers and extend to the interplane strut mounting blocks. The secondary spars are  $\frac{3}{16}$ " balsa. Don't attempt to pin the spruce spars, they will split, use weights or clamps. The main spar has  $\frac{1}{16}$ " plywood doublers front and rear. The secondary spar has one  $\frac{1}{16}$ " plywood doubler. That adds up to  $\frac{3}{16}$ " of plywood doubling the center section of the wing. Also, add a small piece of  $\frac{1}{16}$ " plywood on the rear of the leading edge, and at the end of construction sheet the center section with  $\frac{1}{16}$ " balsa sheet. Furthermore, use fiberglass tape on the center section of the bottom wing.

Let's talk about the interplane struts. Cut them out as per the plans from  $\frac{1}{8}$ " plywood. The wings should have mounting blocks, made from  $\frac{3}{8}$ " square spruce about 1' long, glued in place. Use either 90° small brackets with screws or DuBro Ball Links (no. #180) (\$.85 each, 8 required) to hold the struts to the wing. The prototype used a 1", 2-56 bolt with a washer coming up thru the cabane mounting blocks on the wings with a 2-56 blind nut. The female end of the ball link was then screwed onto the 2-56 bolt. The ball portion of the ball link is screwed to the interplane strut using  $\frac{1}{4}$ "  $\times$  4-40 bolt. The advantage of this method is that they "snap" on and off.

Top and bottom wings are built more or less the same. The bottom wing is shorter and has dihedral, while the top wing is flat. The major differences are highlighted below.

### Top wing

The center section of the top wing must be understood prior to building. The basic design allows the cabane to be reset into the bottom of the wing. The center section also allows for the four bolts that hold the wing. Refer to the detail sketch on the plans and the photographs in the article. The area behind the secondary spar to the trailing edge is filled with balsa scraps. Next, cut the semi-circle over the cockpit as per the plans.

### Bottom wing

The ailerons are separated from the wing when it is nearly completed. Remember, the ailerons are *top hinged*. Install the torque rods and hinges *not* in the center line of the aileron but very close to the top. The reason for this is appearance (reduces unsightly gap) and it helps eliminate aileron flutter. The bottom wing is bolted on in the conventional manner, two bolts and a  $\frac{5}{16}$ " dowel in the

leading edge mating a  $\frac{5}{16}$ " hole in the fuselage former.

### Fuselage

The best way to start is with the plastic cowling. The cowling is from Sig Manufacturing, Smith Miniplane Cowling Sh-564 (\$4.65). Use plastic model cement to glue the halves together. Measure your engine, prop hub to back plate. Get a set of Sig Universal Aluminum Engine Mounts Sh-478 (\$1.89). Figure out how much of the cowling you need. In the prototype about one inch was cut off the rear of the cowling. Now check your cowling against the outline of F-1 front and F-1 rear. Please notice F-1 front is slightly smaller than F-1 rear. Once F-1 is completed get a 2" spinner and put the nose assembly together to find all the necessary holes including holes in the aluminum engine mounts, engine mounting holes, throttle linkage, and tank holes in F-1, and glow plug, needle valve and fueling access in the cowling. The prototype used a Robert Fueler, 8 oz. Sullivan tank and a Semco Pitts Junior Muffler SE-PJ-202 Medium. In the building remember to make a left and right side when adding the  $\frac{1}{16}$ " plywood fuselage doubler. Use epoxy to laminate plywood. (Water base glue will warp parts)

The landing gear is a Bridi Models, dural hardened aluminum bracket L-3 with 3" Du-bro wheels and Gee Bee wheel pants. The whole assembly is held on to the fuselage with 4-40  $\times$   $\frac{1}{2}$  nylon bolts by Ace. This saves a lot of rebuilding after the inevitable "hard" landing. Also, the prototype used a 1" tail wheel on a C.B. Associates CB-TA-510 wheel bracket (\$9.10).

### Empennage

The plans give all the necessary information. Both the stabilizer-elevator and fin-rudder are built "flat". The stabilizer-elevator is then sanded to an airfoil on the top only. The fin-rudder is sanded on both sides to obtain the airfoil. Sand gently, don't break the ribs. Build the stabilizer-elevator together, then sand, cut apart and hinge. Same procedure applies to the fin-rudder assembly.

### Covering and finish

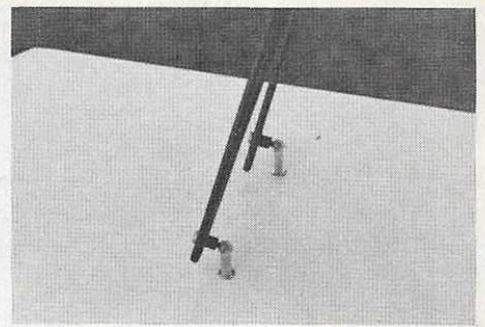
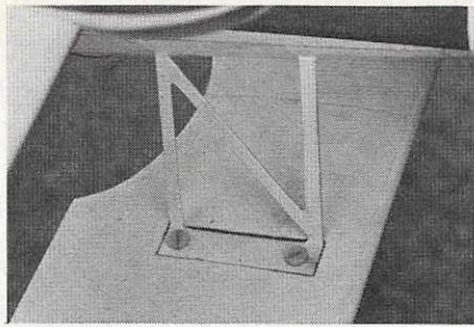
The prototype was covered with white per-glass Coverite and the trim colors were K & B Super Poxy (brushed on). Use your favorite combination, just remember the model should be kept as light as possible especially in the tail area. The prototype used a Prather 2 oz. nose weight for balance.

My biggest criticism of this model is the paint scheme: "It looks just like a Sig Mini-plane." I've heard that comment so many times that I'm thinking of retrimming the ship in a different scheme. Therefore, with a little research perhaps you can find another "scale" paint job to copy.

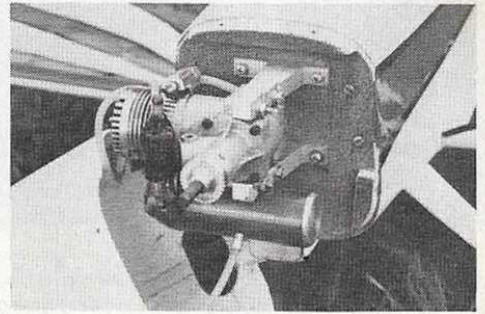
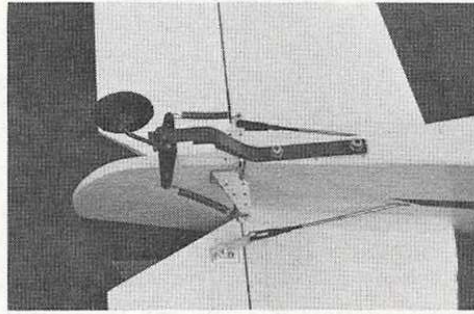
### Flying

The flat bottom wing airfoil creates a great deal of lift and makes for a stable flying model. The prototype had no excessive "ballooning" tendency and flew very well inverted.

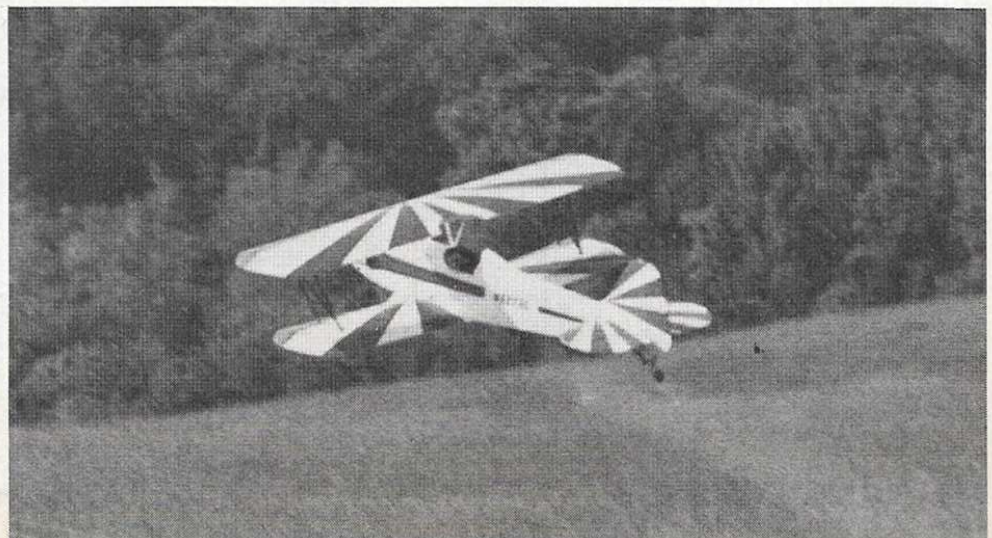
FLYING MODELS



One piece aluminum cabane is attached to wing with nylon bolts (above left). Makes for easy construction. Ball joints simplify installation of wing struts (above right). C.B. Associates tail wheel assembly was used on Combo (below left). Easy, functional way to go. K&B 40 uses Semco Pitts muffler (below right). The muffler fits inside Sig's Smith Miniplane cowling. In fact, Combo does resemble the Miniplane a little.



Author makes engine and radio check before sending the Combo off into the wild blue (above). Smooth take-offs and rock steady flight characteristics are what the Combo's all about (below).



Balance the model as per the plans. The leading edge of the bottom wing is a good place to start, then adjust to your preference after a couple of flights. The batteries go under the tank.

The control surface throws on the prototype were as follows: ailerons  $\frac{3}{4}$ " up and down, rudder  $\frac{3}{4}$ " left and right, elevator  $\frac{3}{8}$ " up and down. All incidence is  $0^\circ$ , no engine thrust, and no washout either.

The prototype weighed just under six pounds and used an old tired K & B .40 engine. Flying performance was excellent. After about 20 flights and doing many acrobatic maneuvers including spins and outside loops, I felt that a little more power might be nice, but then again the scale appearance of the acrobatics would be lost.

A hint on tail-dragger take-offs. Start the take-off roll holding a little up and a little right rudder in the transmitter sticks. Steer the model gently with the rudder. Wait until flying speed is obtained then slowly add up elevator.

Happy landings.



**No, it's not a Smith Miniplane!** That message in the public interest provided by the author. The Combo is actually a conglomeration of a number of ideas which have worked out very well. Combo's a fine flying ship.