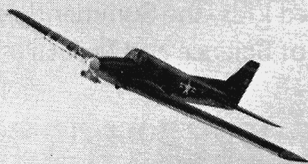


As maneuver and radio requirements changed,
this eight-year-old design has undergone continuous development. A great flyer.



PHOENIX 5

by DON LOWE

THE PHOENIX IS "A beautiful bird. . . used as a symbol of immortality," exactly the right name to see my series of airplanes through many major and minor modifications. I designed the Phoenix 1 to meet a need for something different and beautiful, as well as for aerodynamic advantage—thus, the swept-wing design. Other requirements were good rough air stability, equal stability upright and inverted, and being groovy (whatever that means). Having fulfilled those prime objectives in 1963, the Phoenix design has been refined ever since.

The early configuration was an advanced design concept for accomplished modelers and never was intended for the beginner, although many Phoenix 1's have been built and successfully flown by the novice. As with all highly-swept wing designs, the stall was a little nastier than a straight wing, but certain features, such as a 17 to 19 percent root to tip wing taper for softening the stall, were incorporated. Some say swept-wings are too nasty to fly, but I feel any experienced flier who can recognize a stall condition and can handle a Taurus or Kwik-Fli can safely fly the early Phoenix design. For those less accomplished or for the advanced flier, the present Phoenix is easy to fly and has stall characteristics second to none!

Over the years, the design has had many modifications, such as varying sweep from 12 to 25 degrees (per panel); raising wing and lowering thrust line; changes in nose and tail moments; changes in wing section and area; changes in fuselage profile, offset thrust, etc. The Phoenix 5 is designed primarily for best performance in the AMA and FAI patterns,



Plane on left has fiberglass fuselage, retract, acrylic lacquer. Other, enamel; follows plans.

and no weaknesses in executing current competition maneuvers (including snap rolls) are apparent. (See chart for chronology of the Phoenix design evolution.)

Phoenix 2 and 3 basically explored the effect of sweep variations. Primary findings indicated that increasing sweep may improve lateral stability but hurts performance in pitch. Increasing sweep also hurts performance for the wingover or Figure M, since it decreases the tail moment—unless the fuselage is lengthened or tail area increased considerably.

Phoenix 4 was a move toward the AMA "grab-bag" maneuvers where high maneuverability and snap rolls were required. The airplane also was made smaller to increase

speed. The faster they fly, the more impressive they are, and the better they roll. (Ever watch a Formula I or II do axial rolls? Beautiful!) A switch to a symmetrical airfoil improved the outside, and reduced sweep made it more docile and helped pitch and yaw. Results were gratifying. The Phoenix 4 was very fast, yet had terrific slow speed characteristics. The airplane also knife-edged extremely well, even without the wide fuselage.

Phoenix 5 employs the successful Phoenix 4 wing. The nose moment was increased to improve looks; and the tail moment was increased to help pitch and yaw. The horizontal tail was lowered and the wing raised to get thrust, and to get the wing and tail more in line. Fuselage depth was increased to help knife-edge and all rolling maneuvers. Results? As far as I'm concerned, there isn't a better airplane around. A number of good designs are available and can win, but the big difference these days is the pilot.

My present fixed-gear Phoenix 5 with Marvelite-covered foam wings weighs 7 lb. My son's ship with cardboard-covered foam wings weighs 7 1/4 lb. Another Phoenix 5 with fiberglass fuselage, balsa-covered foam wings, and retract gears weighs 8 lb. This one is extremely fast and is not nasty, but it does land faster than the 7-lb. model. Seven lb. is about the best flying weight, since the airplane is good in a wind, lands easily and flies through the maneuvers easily with a good 60 up front.

Construction

Only a few construction details need

discussion, since I believe in structural simplicity. Fuselage sides of 3/16" medium balsa are made from 4 x 48" stock and are doubled with plywood in the saddle area because of the thin section at the canopy. Build up the turtle back by gluing the sheeting to the side pieces first and allowing to set. Then moisten, glue and pin or tape the soft 3/16" side sheeting to the 3/16" cap. Do both sides together to prevent twisting the fuselage. When dry, glue the second 3/16" cap on top and shape to the cross section shown.

A drum sander (obtainable at many hardware stores) is handy for hollowing out the forward top fuselage block. Fill in around the nose with scrap and shape to the circular nose former and cross sections shown. Pre-drill landing gear, engine mount holes and fuel feed and vent holes prior to installation of the firewall in the fuselage. Former 3 is shaped to cradle a Sullivan 12-oz. square tank. Do not use a round tank because vibration will turn it. A BK nose gear was used on the fixed-gear Phoenix, but many other types are suitable.

To strengthen and enhance appearance, fillets around the horizontal tail and vertical fin are made of Epoxolite, Snowite, or other filled epoxy or polyester materials. Use a constant 1/2" radius fillet around the wing.

Use the hot wire method to cut the wing and horizontal tail from patternmaker's foam. Sheeting may be 1/16" medium or 3/32" balsa soft sheeting, 1/64" plywood Marvelite or .025", 5-ply construction paper (available from print shops). The 1/16" balsa, Marvelite and construction paper form around the leading edge of the wing without difficulty. Anything harder than soft 3/32" sheet will be difficult. Do not attempt to wrap the leading edge of the stab but use separate top and bottom sheets.

A technique for a good bond with minimum glue weight is as follows. Sand the foam cores smooth after cutting. Paint the cores with a light coat of No. 3 shellac, which is applied with small pieces of cellulose sponge. This smooths it on and keeps excess to a minimum. Use the shellac treatment on the cores to seal the foam and minimize the amount of glue needed. Shellac also seals the foam against penetration of solvents, which results in softening and the unbonding of finishing materials when applied later.

Balsa sheeting for the complete wing half is pre-glued and then applied to the wing. Other materials are large enough to wrap the wing half. Draw the entire skin pattern on the sheeting before applying glue and leave about an inch of excess material all around to

accommodate any minor misalignment. When drawing the pattern, locate the wing leading edge parallel to the material grain. Otherwise a good leading edge wrap cannot be made.

Super Weldwood Contact Cement is applied to the skin and core with small pieces of cellulose sponge. When using this glue, it is important to coat the cores with shellac since the glue is very thin and will soak into untreated foam.

To apply wing sheeting, coat the foam and sheeting with contact glue and allow to set. Lay sheeting on a flat bench, align and stick down the trailing edge. With someone holding the sheeting, roll the wing onto the sheeting toward and around the leading edge, being extremely careful to pull tightly and press firmly when rolling around the leading edge. Continue the operation, rolling back to the trailing edge. Ensure good all-over contact by rubbing firmly.

Join the wing panels after covering and wrap the joint with light fiberglass cloth and epoxy. Use a sander to grind down the front of the wing to the flat shown and inset the plywood piece. I use a 1/4" aluminum dowel and run it back to a 1/4" hole in the dihedral brace.

The ailerons cannot be made of standard trailing edge stock because of their thickness at the leading edge. This yields a desired soft aileron response around neutral.

Assembly

Set the wing, tail and engine at zero-zero. I have tried offset thrust on this design but never could trim the airplane properly. (Offset seems to work on Phoenixes 1 through 4.) Balance is not too critical; just try to get close to the balance point shown. If it sits on the nose gear hard enough to steer that will be safe. When a Phoenix 5 with the CG 1" behind that shown on the plans was flown recently, it had no bad characteristics.

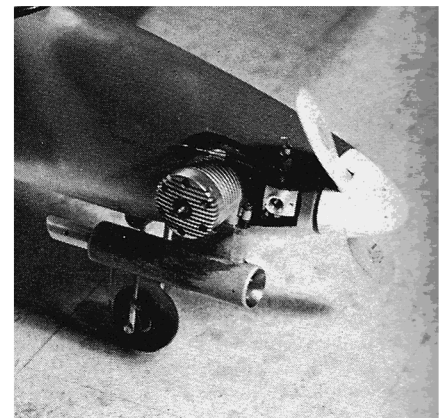
Set up the ailerons with zero differential. Rake elevator horns forward 15 degrees as shown to provide more down than up. Keep the elevator horns as close as possible to the fuselage. Rudder throw should be the maximum possible, especially for the wingover or Figure M. The elevator pushrod is simply a single rod back to forked Du-Bro Kwik-Links. Keep bends to a minimum and try for a straight shot to the elevator horns. A little angling out through the side slots will be necessary. Bend against the sides of the fuselage to give stability and to form a guide for the twin Kwik-Links.

Keep pushrods as straight as possible to preclude buckling and poor control. Always use the maximum of wood and a minimum of wire. Never use 90-degree bends. Should they seem necessary, rework the installation to

eliminate or reduce the bends. A good test is to apply a load to the surface. If the pushrod buckles before the servo moves, it isn't good enough. As preliminary control settings use the following: 1/4" up and down for ailerons; 1/2" up and 5/8" down for elevators. The rudder on my Phoenix moves 1 1/4" right and left. These movements may be adjusted to suit individual taste and style of flying.

Flying

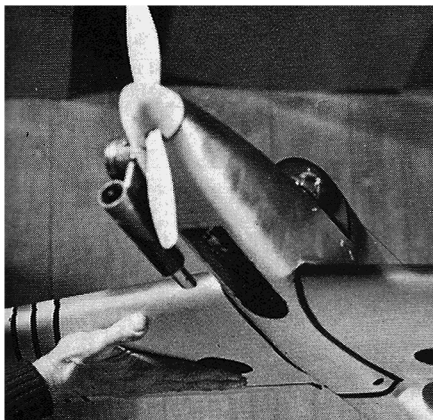
The not-so-expert will find this airplane a little on the fast side, because of its clean design and small cross section. It is by no means nasty and simply goes in the direction it's pointed. It will land hot unless the pilot flares. It can be held off to a good angle of attack without stalling and it settles in very well. Main gear landings can be made without touching the nose for a touch and go. Every maneuver, including the knife edge, can earn ten points if the flier is proficient enough. I have done 180-degree turns in knife edge.



Standard knife edge is automatic without corrective elevator or ailerons if trimmed properly.

The ship will not loop in knife edge, but it is not designed for that maneuver. Spins upright or inverted are easy, with a little more lead required for recovery from upright. Snap rolls are a "snap," with quick recovery either inside or outside. Slow speed or partial throttle maneuvers are fun, since the ship handles well at slow speed.

Fiberglass fuselages are available on a custom, limited-order basis from Jim Masters, 7410 N. Dakar Ave., Dayton, Ohio. Weighing about a pound with beam mounts and firewall installed, they incorporate a beautiful deep wing fillet and a solid canopy area.



DESIGN EVOLUTION OF THE PHOENIX

	Wing Area	Wing Sweep	Wing Section	Other
Phoenix 1	720 sq. in.	23 degrees	Semi-symmetrical originally, 17 to 19 percent root to tip	
Phoenix 2	720 sq. in.	15 degrees	Semi-symmetrical originally, 17 to 19 percent root to tip	Decreased tail moment
Phoenix 3	720 sq. in.	25 degrees	Semi-symmetrical originally, 17 to 19 percent root to tip	Raised wing Lowered engine
Phoenix 4	640 sq. in.	12 degrees	Symmetrical originally, 17 to 19 percent root to tip	Shortened nose and tail moment Raised wing
Phoenix 5	640 sq. in.	12 degrees	Symmetrical originally, 17 to 19 percent root to tip	Lengthened nose and tail; increased fuselage side area; raised wing; lowered tail