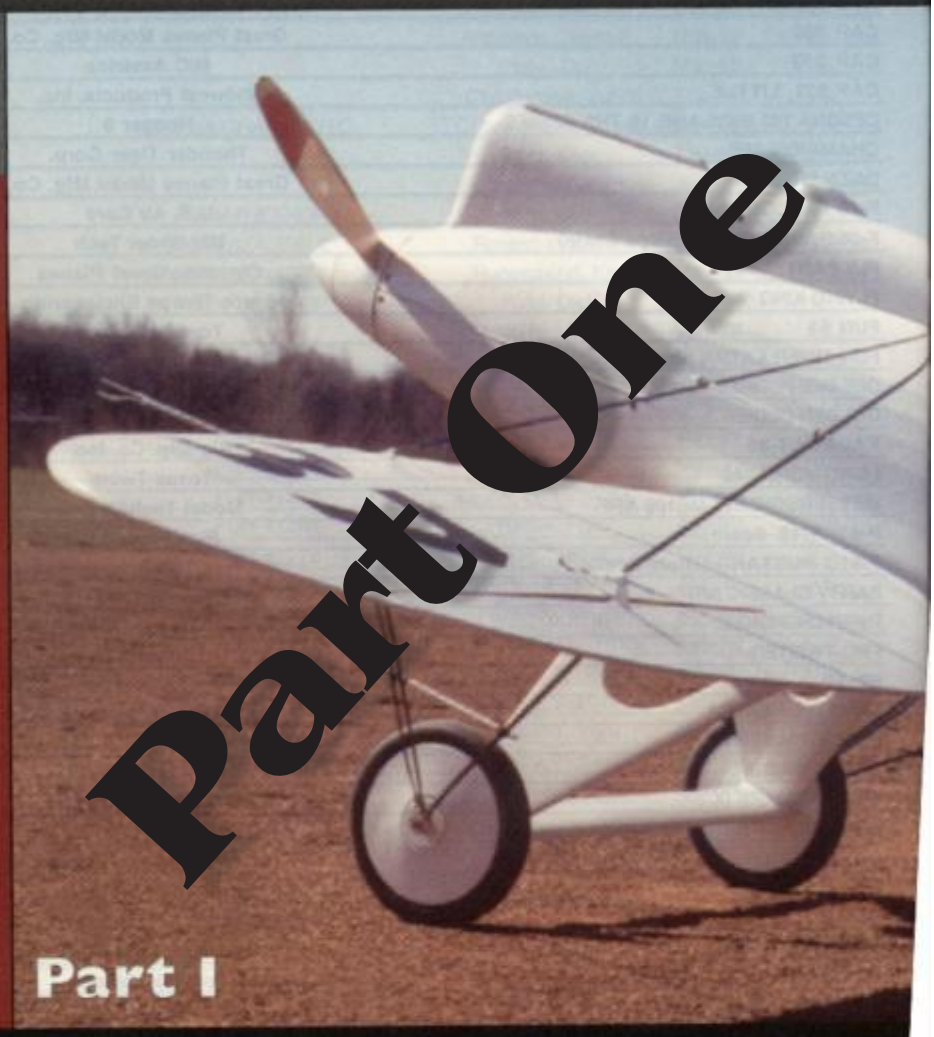
HOWARD



A One-Third Scale Model Of Benny Howard's Classic Air Racer

HOWARD PETE
Designed by:
David P. Andersen
TYPE AIRCRAFT
Scale (1/3)
WINGSPAN
80-1/3 Inches
WING CHORD
16 Inches (Max)
TOTAL WING AREA
1056 Sq. In.
WING LOCATION
Low Wing
AIRFOIL
Scale NACA M-6
WING PLANFORM
Constant Chord, Rounded Tips
DIHEDRAL, EACH TIP
3°
OVERALL FUSELAGE LENGTH
71 Inches
RADIO COMPARTMENT SIZE
Ample
STABILIZER SPAN
32 Inches
STABILIZER CHORD (inc. elev.)
10-3/4 Inches (Avg.)
STABILIZER AREA
345 Sq. In. (33% of Wing Area)
STAB AIRFOIL SECTION
Symmetrical (Thin)
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
13 Inches
VERTICAL FIN WIDTH (inc. rud.)
11 Inches (Avg.)
REC. ENGINE SIZE
1.50 Cu. In. 4-Stroke
FUEL TANK SIZE
24 Oz.
LANDING GEAR
Fixed Conventional
REC. NO. OF CHANNELS
5
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail., Flaps
C.G. (from L.E.)
6 Inches (36%)
ELEVATOR THROWS
2-1/4" Up — 2-1/4" Down
AILERON THROWS
1" Up — 1" Down
RUDDER THROWS
2-1/2" Left — 2-1/2" Right
SIDETHRUST
0°
DOWNTHRUST/UPTHRUST
0°

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa & Ply
Empennage	Balsa & Ply
Wt. Ready To Fly	272 Oz. (17 Lbs.)
Wing Loading	37 Oz./Sq. Ft.

"It was fast and it could haul a lot of whiskey," Benny Howard said of one of his early airplane designs. Creating airplanes for bootleggers gave Benny "Go Grease" Howard experience designing fast airplanes, and it bankrolled his real ambition -- air racing.

Pete was built in 9 months from junkyard parts and a borrowed Wright Gypsy 4-cylinder engine. Benny Howard, then a pilot for United Airlines, completed Pete in time for the 1930 National Air Races.

Pete won everything in its class. On a lark, Howard entered Pete in the Unlimited Class, the Thompson Trophy Race. The diminutive Pete, with its 82-horsepower engine, was up against racers powered by engines of as much as 700 horsepower. Pete was not given a chance.

Speed Holman won the race with his big Laird Solution, and Jimmy Haizlip came in second with a Mystery Ship. The little Pete breezed into third place by outmaneuvering the bigger racers, skimming close to pylons and pulling around them with vertical wings in high-G turns. A reporter called Pete "a ballerina among heavyweights."

Pete became famous and won many races. The purses funded Howard's next designs -- the famous Ike, Mike, and Mister

PETE

By David P. Andersen

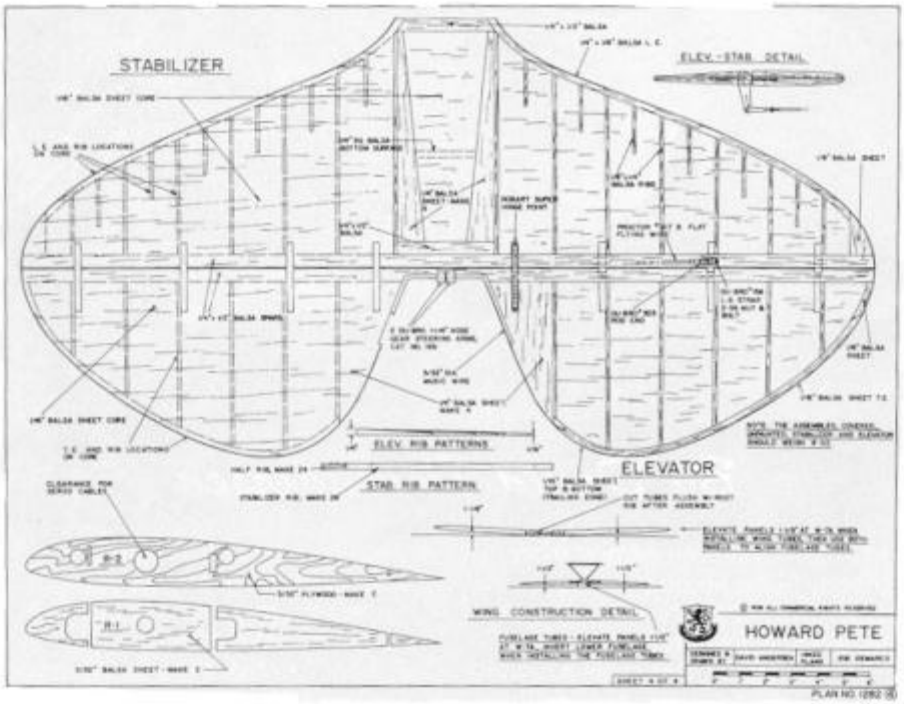
Mulligan. But Pete earned more money flying aerobatics in airshows. At the time, Pete was an airshow favorite.

In the 1930s, Pete was a favorite for modeling too. Its stability, long fuselage, and long landing gear were ideal for the rubber-powered models of the time. Many feel that Pete was the prettiest of the Golden Age air racers.

Pete's design was unusual for a racer. The large control surfaces were better suited for aerobatics than racing. Most air racers of the era had tiny tails, but Pete's tail is huge -- the span of the stab is almost half the wingspan. This gives Pete a rare combination of stability and control. I know of no other airplane of any type which has such a large tail-volume-to-wing-area ratio. It makes one wonder whether Pete was actually designed for racing at all.

Another curious feature is the exceptionally long landing gear. This, no doubt, is the reason the plane is rarely modeled in R/C. Modelers fear that the long landing gear will cause the airplane to nose-over. Such is not the case. Pete's unusually large horizontal stabilizer, forward wheel position, and long tail moment more than compensate for this. They hold the tail down in the roughest field and the longest grass.

Benny Howard relaxes after winning everything in Pete's class in the 1930 National Air Races. Photo courtesy of Rudy Profant collection.



The landing gear is far too long for prop clearance. The purpose is to support the wings in very high-G pylon turns and aerobatics. It also helps stop the plane when landing. When the tail skid is on the ground, the angle of attack is above the stall angle. At a landing speed of 60 mph with no brakes, the trick was to dig the tail skid into the dirt after touchdown. The combined drag of the tail skid and fully stalled wings were enough to stop the airplane in the grass fields of the day. Even so, landing at 60 mph with no forward visibility, no brakes, and a rigid landing gear, must have been difficult and scary.

The combination of thin airfoil, no wash-out, and rigid landing gear would be a handful for an R/C modeler too. At least visibility is better. But there is more we can do — flaps!

The addition of nonscale flaps tame the landing and make landing more scale, too. Flaps add lift and drag, allowing steeper approaches without build-up of airspeed. Flaps slow the landing speed of the model Pete to about 30 mph. But, more importantly, flaps increase the effective angle-of-incidence of the inner wing, adding a form of wash-out that reduces the danger of the wingtips stalling during the landing approach and flare. Pete's exceptionally large tail keeps Pete stable at these low airspeeds.

With a slow, stable, and controlled landing, the rigid landing gear accepts the ground reasonably well, especially on grass strips. There is a tendency to bounce on hard-surface runways -- they were unknown and unneeded in the early 30s. Bounce can be minimized by immediately raising the flaps at touchdown. This kills lift. Replacing the tail skid with a steerable tail wheel is a must for steering on hard-surface runways.

The last reason to not model Pete in the past was the difficulty of enclosing a muffler in the narrow cowl; but many of today's engines feature rear-facing exhaust ports so that the muffler can be tucked behind the engine. Pete's cowl has no nonscale cutouts, not even for the needle valve.

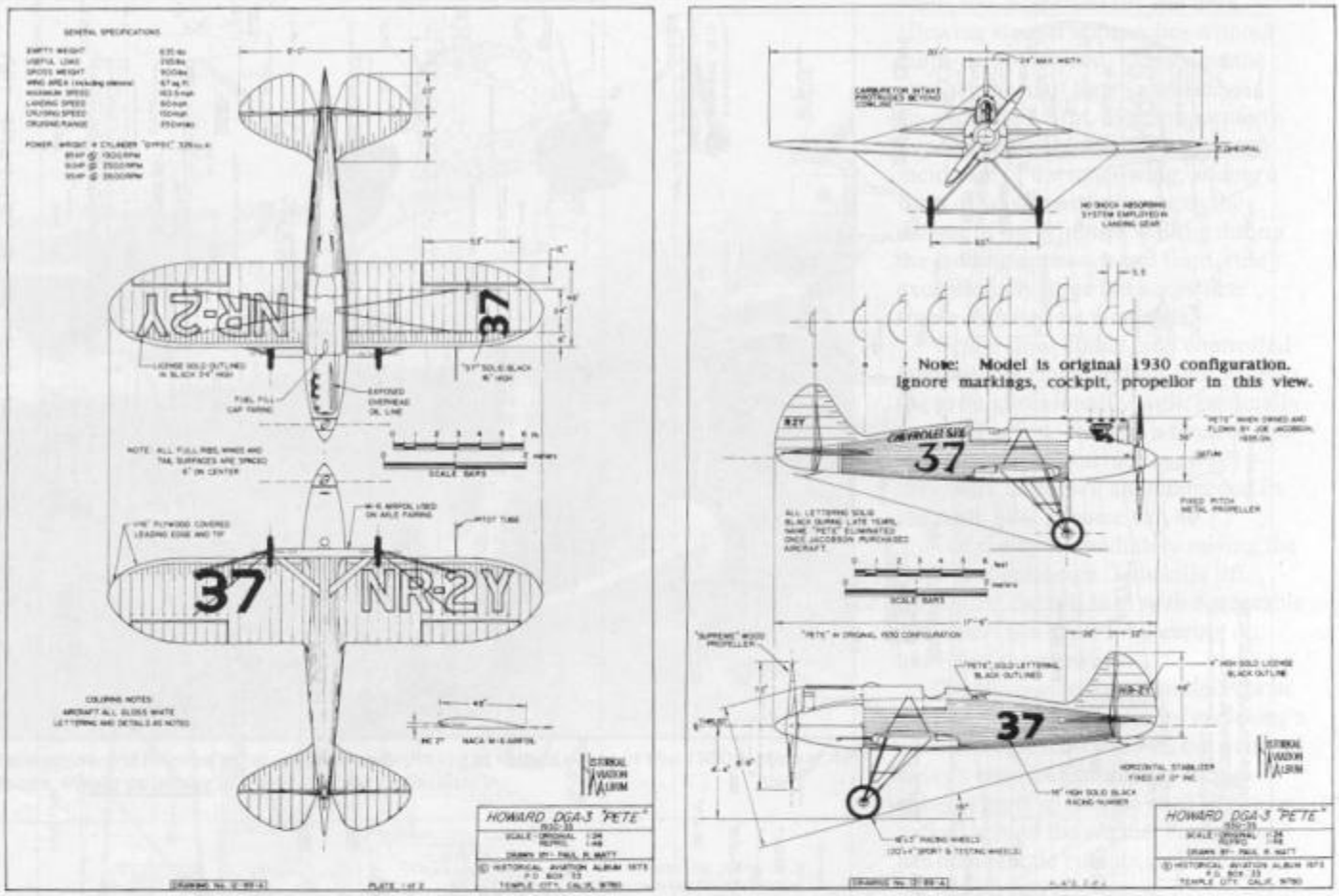
One-third scale seems to be about right for Pete. Larger would require speed to be too fast, making the sky too small for a model airplane; smaller scale would require flying faster than scale speed and would cause ground-handling problems.

Pete requires no up-elevator during the take-off roll, even when the axle drags through the grass. Its big control surfaces and short wing are ideal for airshow aerobatics, but when the flaps are lowered on final approach, it becomes stubbornly stable.

Pete should be flown *allegro ma non troppo* -- fast, but not too fast. The full-sized Pete had a landing speed of over 60 mph, a cruise speed of 150 mph, and a top speed in level flight of 180 mph -- twice as fast as a Volkswagon, and the same amount of power. The one-third scale model Pete's speeds have been measured with a radar gun. It showed that the Saito 150-powered model Pete can reach a top speed of over 70 mph and cruise at 50 mph. With a 10 mph headwind, Pete can land at the scale speed of only 20 mph.

CONSTRUCTION

The plans have no deviation from scale outline, and other than the flaps, this is an exact scale model of Pete, as it was configured for the 1930 National Air Races.



Paul Matt drawings provide complete contest documentation. Refer to these drawings during construction too.

The model Pete was designed by blowing up the Paul Matt drawings (see references). These drawings are all you need for contest documentation. The photo set by Bob Banka is very helpful for close-up details during construction.

This airplane has a bazillion parts! If it were a kit, labor would cost a fortune. But your labor is cheap. There are services available to cut parts for you, but why should they have all the fun? Cutting parts is the easiest part of building an airplane — and it is fun.

Photocopying parts from a copyrighted drawing for your own use in order to build a machine, is permitted under the Fair Use Doctrine of the copyright laws. So I recommend that you make patterns by photocopying each of the parts. Lightly spot-glue them to stock with a Kinko's glue stick or equivalent. Cut out each part with a scroll saw and sand the edge with a small disk sander, removing half of the line. Peel off the pattern.

Metal parts can be made the same way, except the pattern should be attached with double-faced Scotch tape.

Construction is exactly scale on the outer surface down to the last stringer and rib. This makes the construction seem a bit complex, but there is no weight penalty. Use only 4-6 lb. balsa, and spare the glue. Light weight is important for good performance.

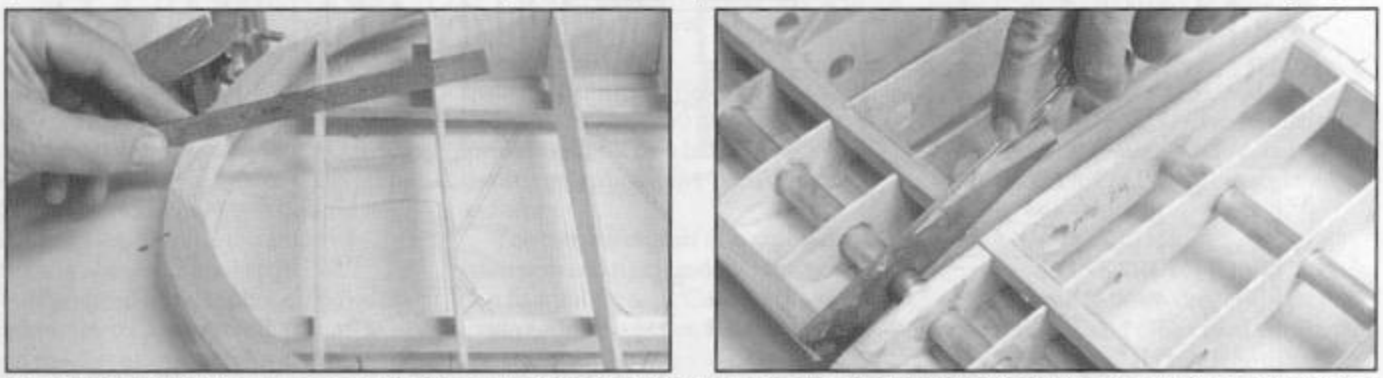
The recommended sequence of assembly is as follows: wing panels, landing gear, tail, fuselage, covering and painting, and wing wires.

This airplane can be framed up, less radio and engine, for a total cost of less than $200.00.

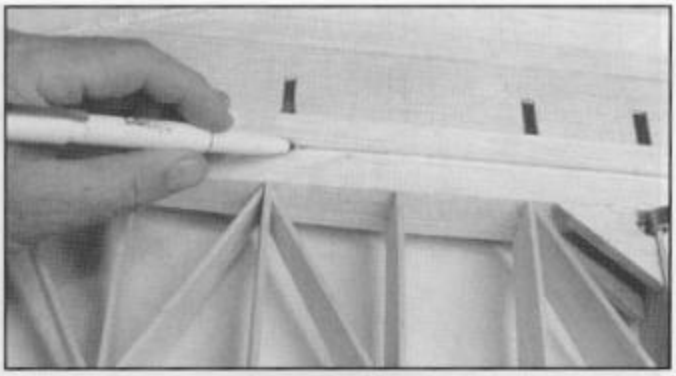
Wing Construction:

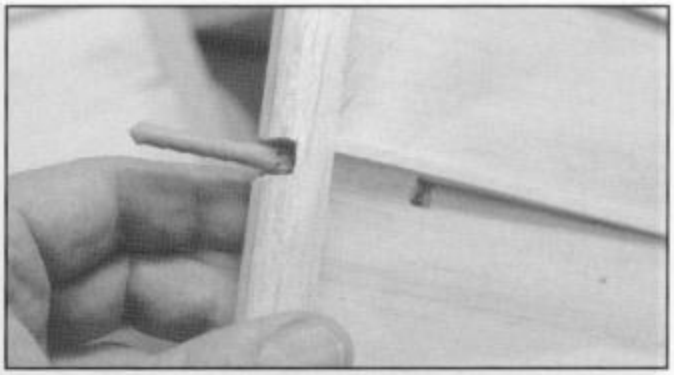
Start with the ailerons. Make a photocopy of the ailerons with the darkness control set as dark as possible. Lay the photocopy face-down on 1/16" sheet balsa and iron it with a hot iron. The pattern will transfer to the wood in a reverse image. Cut out the aileron base, including the slots for the Robart hinges.

Assemble the aileron leading edge

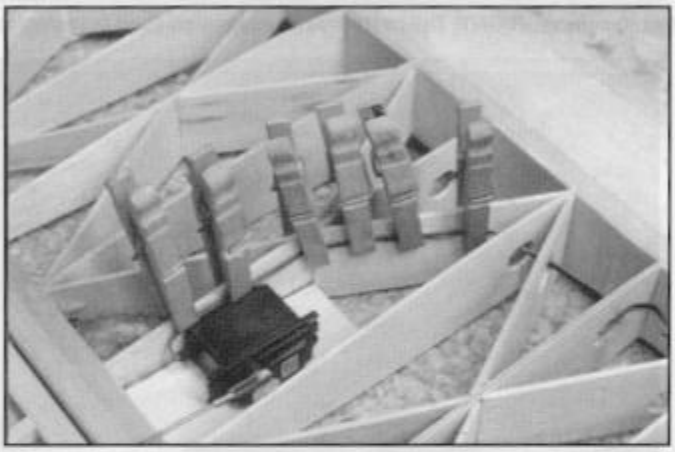


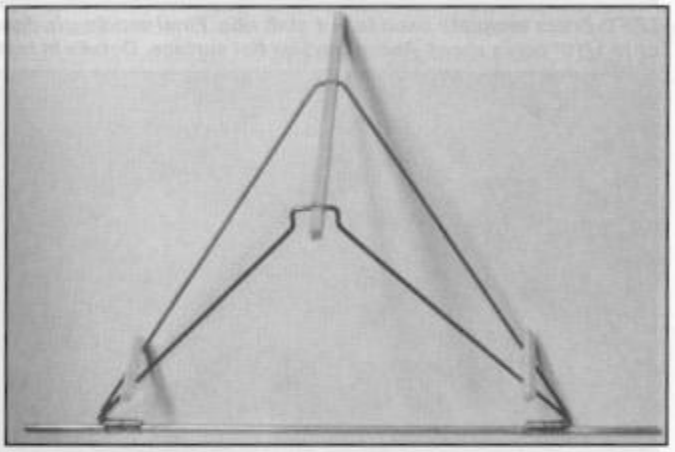
LEFT: Tip is beveled to match outer two ribs. Tested with straightedge before sheeting. RIGHT: Wing tubes are cut after mating wings. Assures perfect alignment.



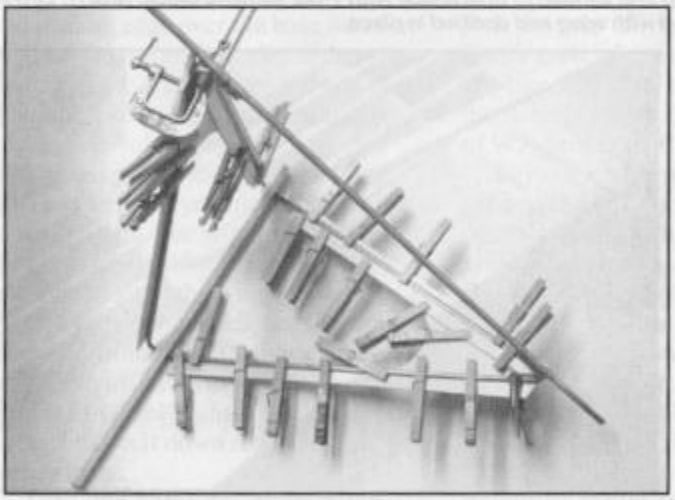


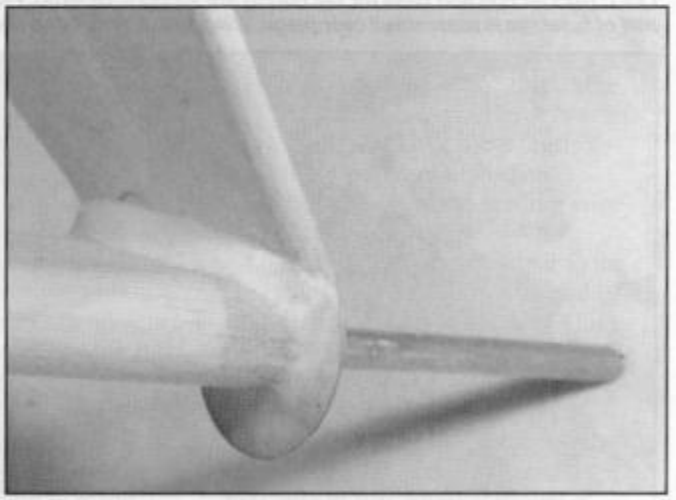
LEFT: Shape of trailing edge is traced onto aileron. Shaped and rounded before attachment to wing. RIGHT: Robart Super Hinge Point is epoxied into aileron. Hinge line is recessed to center of radius of rounded leading edge.



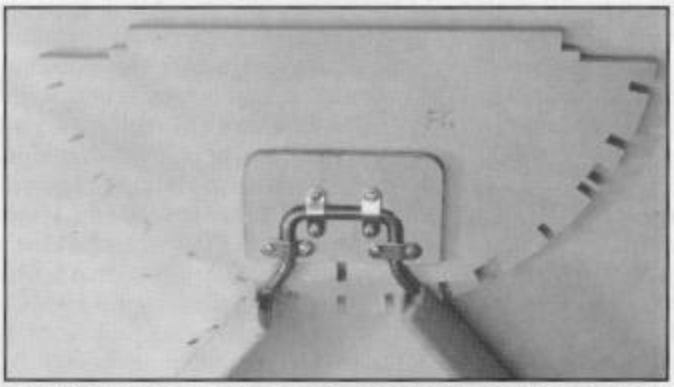


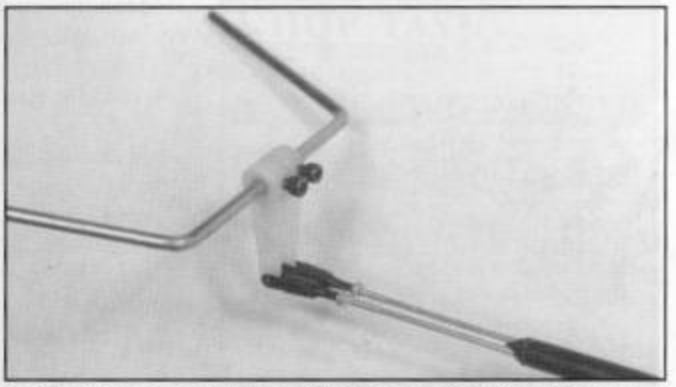
LEFT: Aileron servo glued in place. Short straight pushrod. Cable glued down to prevent abrasion. Cross ribs prevent wing warp. RIGHT: Notched balsa sticks CAed to landing gear hold everything together for soldering.



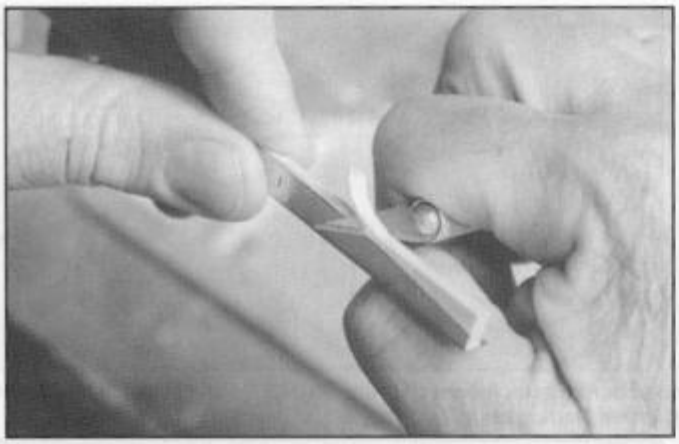


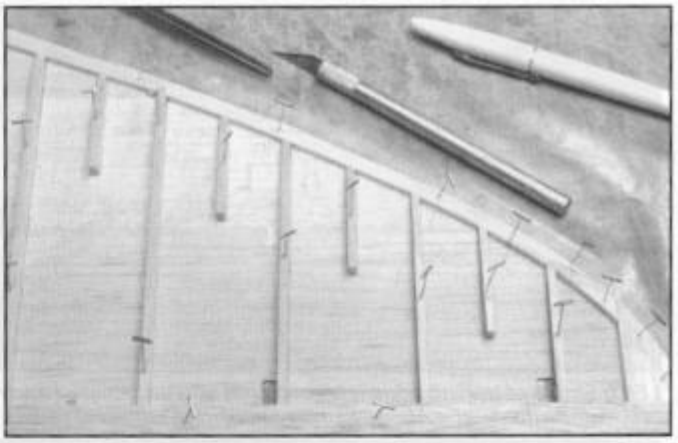
LEFT: Balsa and ply landing gear fairings epoxied in place. RIGHT: Fender washer initially tack-glued in place using wheel for alignment. Then scale fillet formed from Epoxy Plus.



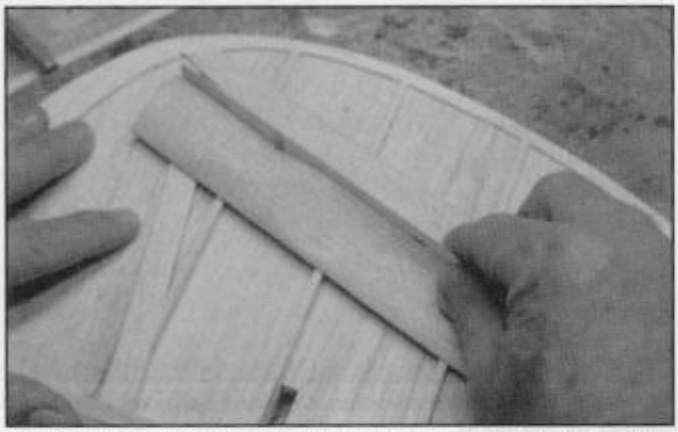


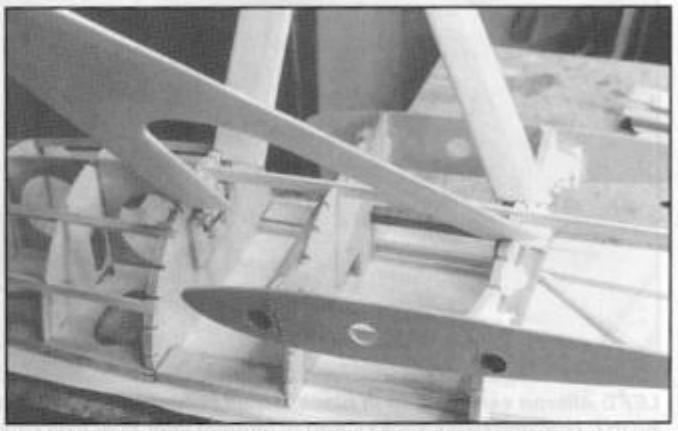
LEFT: Completed landing gear is attached to fuselage formers before fuselage assembly. I used Du-Bro Landing Gear Straps and extra long screws. RIGHT: Elevator horn is two large nosewheel steering arms. Dual-clevis carbon fiber pushrod. Secured with high-strength Loctite.



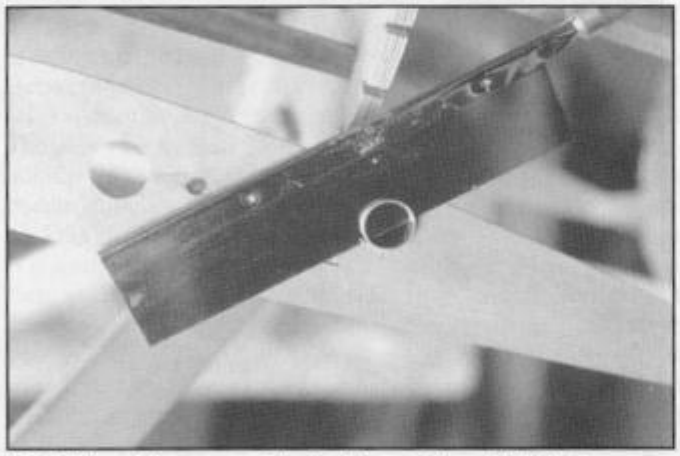


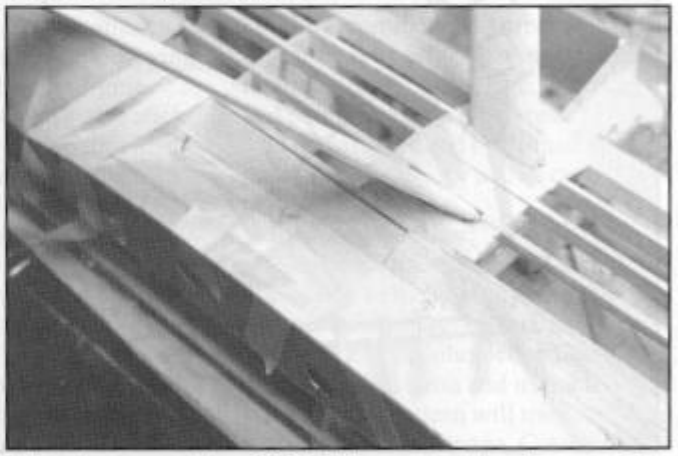
LEFT: Brass template used to cut stab ribs. Final sanding is done after assembly. RIGHT: Tail pattern is photocopied then transferred onto 1/16" balsa sheet. Assembled on flat surface. Details in text.



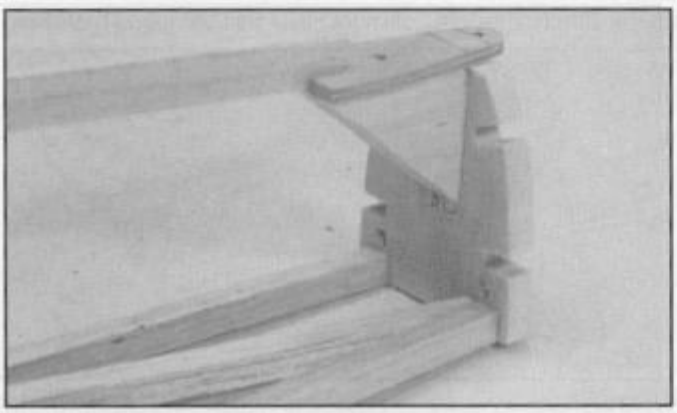


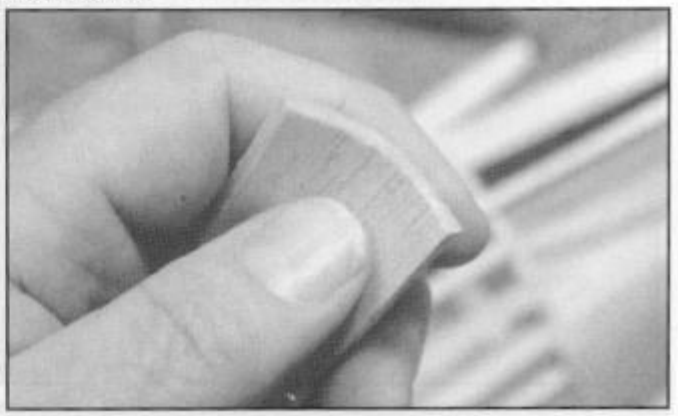
LEFT: Rudder ribs and base for tail fairing are straight-tapered. Planed and sanded to final shape with T-bar sanding block. RIGHT: Lower half of fuselage is assembled over plans. Wing tubes have been aligned with wing and epoxied in place.



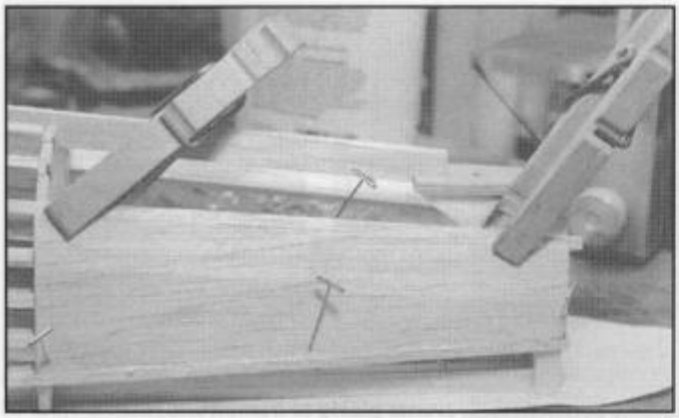


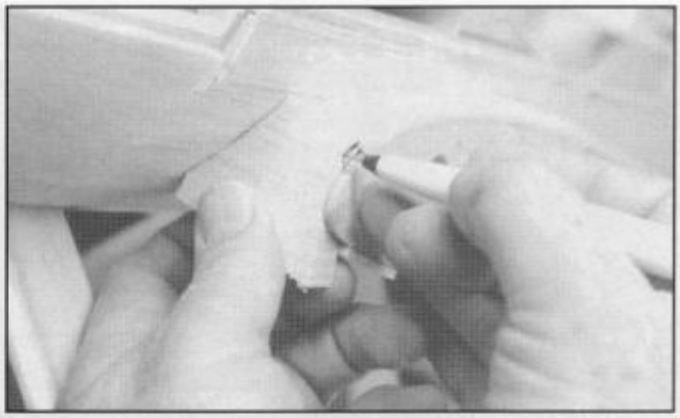
LEFT: Wing tubes are cut flush with root ribs with X-Acto razor saw. Hole is for servo cables. RIGHT: Wing root and landing gear joints are sheeted with 3/32" balsa. Masking tape and pins hold sheeting while glue sets.



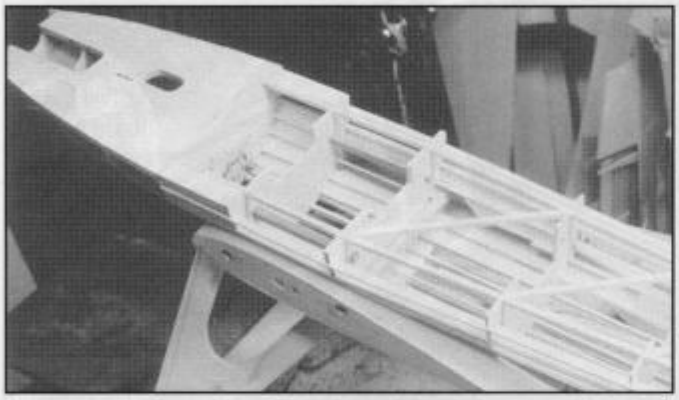


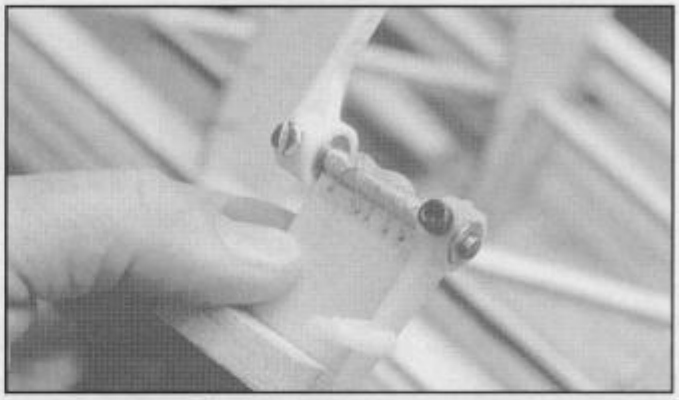
LEFT: Ply tail skid support allows field replacement with non-scale steerable tail wheel. RIGHT: Rear sheeting is bent by rubbing hot water onto outer surface and molding with fingers.





LEFT: Bent sheet balsa applied to tail area of fuselage. Reversed clothespins hold while Elmers glue dries. RIGHT: Leading edge of wing root requires a small balsa block. Trace shape and cut to shape before installation.





LEFT: Lower half of fuselage. Lots of room to install radio and engine stuff. RIGHT: Throttle bellcrank made from two nose gear steering arms and brass tube wired and epoxied to ply mount. Install behind engine.

and trailing edge over the base on a flat surface. Do not add the ribs at this time. Flip the aileron over and add the other half of the leading and trailing edges. Set aside for now.

The wing is an inverted gull wing. This has an aerodynamic effect similar to wing fillets. The wing panels are plug-ins, using aluminum tubes for support. Most of the wing stress is borne by the wing wires, not the wing tubes. I estimate that the wing tubes alone are sufficient to support the airplane in level flight -- just strong enough to get it down if a wing wire comes loose.

The wing wires detach from the fuselage and landing gear axle for transport. Field assembly consists of sliding the wings onto the tubes, connecting the flap and aileron servo cables, and inserting four bolts and two cotter pins. The four bolts holding the landing wires to the fuselage are safety-wired with copper wire. I am not certain that the safety wire is necessary, but I am not willing to find out!

Begin wing assembly by cutting out all of the wing parts. Cut the aluminum strut fairings from K&S 1/16" sheet aluminum, available from most hobby shops. Alternatively, use three Du-Bro #202 Nickel Plated Steel Straps per rib. Bolt the strut fairings to rib W7 well. These must support the weight of the airplane in high-G turns. Be sure that the fairings are on the **outboard** side of W7. Secure with Loctite and epoxy.

Lay out a wing panel plan over a flat surface and pin wooden blocks at each rib station -- 1/2" thick at the forward spar and 3/4" thick at the rear spar. Overlay the whole plan and blocks with Saran Wrap or other clear plastic to prevent glue from dripping onto the blocks and the plan. Lay the lower wing spars on the blocks. Pin only the front spar in place, let the rear spar lay free. Glue the wing ribs in place, weighting or pinning them in place. W1 must be warp-free and exactly perpendicular or else there will not be a good fit to the fuselage. Align it with a triangle.

Do not attach the wing tubes at this time.

Glue the leading edge in place, but do not shape it yet.

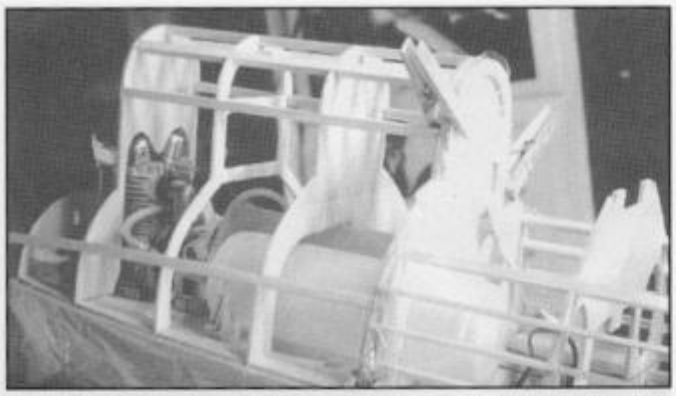
Note that the leading edge sheeting is two layers. The inner layer extends from the leading edge spar and is butted up to, not overlaying, the main spar. Shape the leading edge after the inner sheeting is in place.

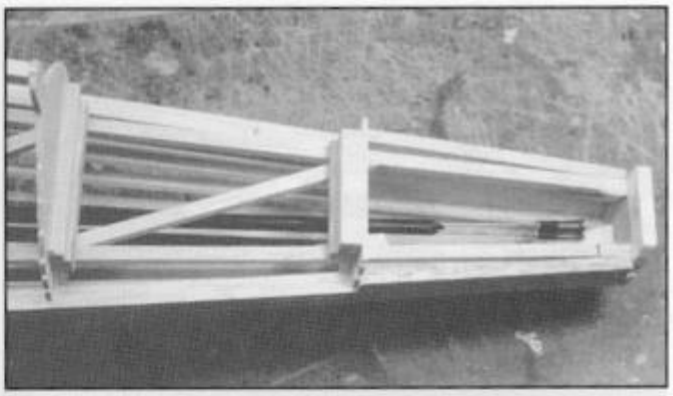
Plane the wingtips to a flat, sloping surface that aligns with wing ribs W11 and W12. Use a straightedge for a reference.

Next, we add the outer wing sheeting. It is only 1/16" thick and 1-1/2" wide. Glue it in place over the leading edge. Cover the wingtips from W11 outward also. This emulates the plywood leading edge of the full-sized Pete.

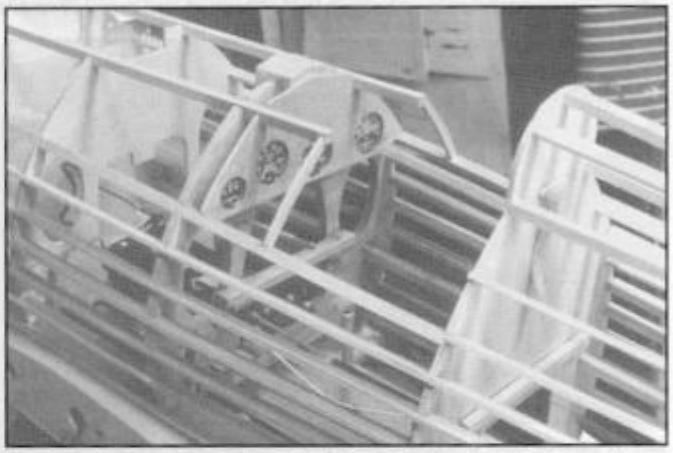
Add the 1/8" x 3/8" subspar to the rear spar in the aileron region and plane it down to the wing ribs. This will result in a gradual taper towards the wingtips. Do not add the 1/16" x 3/8" capstrip at this time.

Add 3/32" sheer webbing, vertical grain, to the entire front spar and the rear spar to W6. Sheer webbing is

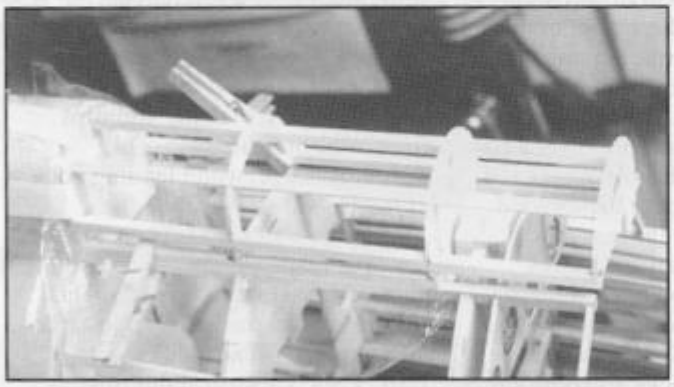


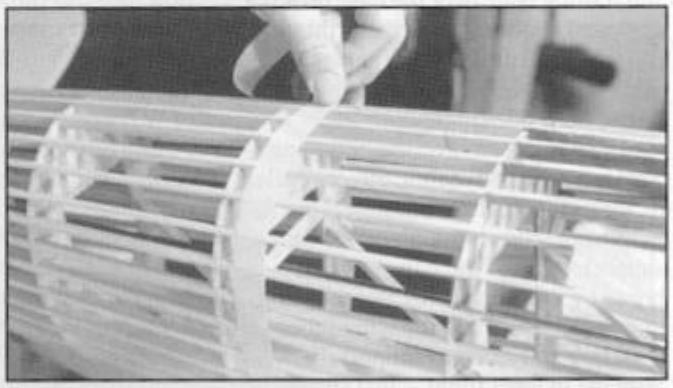


LEFT: After radio and engine installation, cowl frame is assembled in place. Saran Wrap prevents gluing to framework. RIGHT: Rear of fuselage ready to accept tail. Dual-clevis carbon fiber elevator pushrod in place.



LEFT: Soft balsa tail fairing is shaped with razor plane and sanding block before installation on rudder. Bob Banka photo used as a guide. RIGHT: Cockpit complete with throttle and joystick. All visible wood stained light brown.





LEFT: Hatch structure being assembled on fuselage. Ready for sheeting. RIGHT: Stringers being checked for evenness with masking tape, sticky side out.

necessary for wing strength. Don't omit it even though it is tedious to cut.

Glue the cross ribs X1 through X6 in place, beveling each edge for a good fit. These things prevent the wing from warping. They also prevent it from fluttering in a dive. It is interesting to twist the wing in your hand before and after adding the cross ribs. Try it and feel the difference in rigidity.

Build both wing panels, but do not sheet the bottom surface yet -- we need it open in order to fit the wing tubes.

Cut two 14" lengths of 5/8" x 0.028" aluminum tubing. Roughen the outer surfaces with sandpaper so that epoxy will have little grooves to get its fingers into. Lay both wing panels on a flat surface (like the floor) over some waxed paper. Slide the wing tubes into the holes in ribs W1 through W4. (You did remember to cut them, didn't you? If not, you have a problem.) Adjust the two W1s to be about 2" apart (not critical). Verify that the leading edges of both wings lie in a straight line (critical). Remove material from the rib holes, if necessary, for a good semi-loose fit of the wing tubes.

Now remove the wing tubes and coat the rib holes in W1 through W4 with slow-set epoxy. Coat the tubes, too. Don't get any glue inside the tubes. Re-insert the tubes into the wing panels and align on the floor again. Prop up each panel 1-1/8" at W7 for dihedral. Let cure.

Flip the wing over and cut the wing tubes flush with W1 using a razor saw. Sand the edges flush with the outer surface of W1. This procedure assures a perfect alignment later when we insert the inner wing tubes into the wing panels.

Inspect the glue joints of the wing tubes. Add a fillet of Epoxy Plus around the tubes at W4 and the outboard surface of W1.

You may now complete the leading edge sheeting on the bottom of the wing panels. Plane the lower surface of the rear spar to match the ribs in the aileron area. We can now fit the ailerons.

Hold a partially completed aileron in place on the wing. Tape or pin it to the rear spar. Trace the shape of the

wing spar onto the aileron leading edge. Remove the aileron and plane its leading edge down to this line. Later, when the aileron is mated to the wing, there will be a perfect fit even though the rear spar capstrip is not yet in place. Trust me.

Add 1/2" x 1/4" ribs to the ailerons and plane them to shape. Sand them to final shape with a large sanding block so that they are flush with the aileron leading and trailing edges.

Next, round and sand the leading edge of each aileron to form a semi-circle with the hinge points at the center.

Cut tapered slots in the aileron leading edges and fit the Robart hinges. Note that the hinge points are recessed well into the leading edges. The hinges should swing at least 45° up and down without binding. Epoxy the Robart hinges to the ailerons. A fillet of Epoxy Plus or other gap-filling epoxy along each rib should be applied also. Each aileron requires five hinges. Don't skimp or you may experience aileron flutter.

The flaps are tapered warp-free 1/4" sheet balsa attached to the rear spar, with lots of Klett hinges on the outer surfaces. Cut both flap horns from stacked aluminum sheet so that they are exactly identical. If they aren't, the plane will roll when the flaps are lowered. Epoxy and block them in place well.

Add the 3/32" flap servo base between W3 and W4. Add the 1/8" aileron servo bases between the outer W7s. Brace with balsa strips. Add the servos now. Glue them in place with Zap-A-Dap-A-Goo or other flexible glue. Use new, identical servos so that left and right wing motions will be identical. This is especially critical for the flap servos. Modern servos are cheap, maintenance-free, and will outlast the airplane, so there's no need to make them removable.

Add the 1/16" x 3/8" capstrip to the rear spar from W6 to the wingtip. Add 1/16" x 1/4" capstrips to all of the ribs of the entire wing. The capstrips cover the flaps, too. Bevel both ends of the capstrips at the flap hinge. The flaps should lower at least 60° before the ends of the capstrips meet.

Trial-fit the ailerons to the wings and sand their surfaces flush with a large sanding block. You may glue the ailerons in place now, or, if you prefer, add them later, after covering.

Later, we will cover the wing with Sig Koverall or other fabric. The fabric will cover the flap hinge without a gap. When the flap comes down, the fabric will fold and wrinkle, to be pulled tight when the flaps are raised again. The objective of this nefarious scheme is to hide this secret weapon from scale contest judges.

After the wing is covered and primed, add a plastic strip over the aileron hinge gap. Model railroad styrene works well. Glue it to the wing only. It's supposed to bend with the aileron. Kinda neat, huh?

Landing Gear:

The landing gear is rigid music wire inside ply and balsa fairings. Like the original Pete, the only shock absorbing is the tires and the resilience of the struts, so it must be very strong. It is, therefore, somewhat heavy.

Lateral support of the landing gear struts is provided by the lift wires to the wing. The axle is music wire inside a brass tube, inside another brass tube, inside a wooden fairing. Holes in the end of the brass axle tube accept a cotter pin that holds the wheel and lift wires in place.

It is necessary to build the landing gear before assembly of the fuselage because the landing gear will be installed as a unit.

Using a K&S or Breiten wire bending tool, bend 3/16" music wire per the patterns shown on the plans. Cut a 17/64" brass tube slightly longer than the axle shown on the plans. Using a heavy-duty soldering iron or torch, tin the ends of the wire and the brass axle tube where it will meet the struts. Cut notches in a 1/4" balsa stick spaced exactly equal to the spacing between F6 and F10. CA glue the notches to the upper end of the struts. Hold the lower end of the struts together with similarly notched balsa

HOWARD PETE MATERIAL LIST

All material is 4-6 lb. balsa, unless otherwise specified, and all dimensions are listed in inches:

- 3 — 36 x 4 x 1/16
- 10 — 36 x 4 x 3/32
- 4 — 36 x 4 x 1/8
- 1 — 36 x 3 x 3/16
- 1 — 36 x 4 x 1/4
- 1 — 36 x 3 x 3/8
- 1 — 36 x 3 x 1/2
- 1 — 18 x 3 x 3/4
- 6 — 48 x 3/8 x 1/2
- 4 — 48 x 1/8 x 1/4
- 20 — 36 x 1/4 sq.
- 4 — 36 x 3/16 x 1/2
- 12 — 36 x 3/16 x 1/4
- 1 — 36 x 1/2 x 1/4
- 5 — 48 x 3/8 sq. (spars -- straight!)
- 30 — 36 x 1/8 x 3/8
- 2 — 36 x 1/16 x 3/8
- 4 — 48 x 3/8 x 1/2 (spars -- straight!)
- 2 — 36 x 3/16 x 1/2
- 1 — 18 x 9 x 3/8 ply
- 1 — 36 x 12 x 1/8 ply
- 1 — 18 x 12 x 1/4 ply
- 1 — 36 x 12 x 1/8 ply
- 1 — 18 x 12 x 3/32 ply
- 1 — 4 x 8 x 1/16 K&S duraluminum
- 3 — 36 x 3/16 dia. music wire
- 1 — 36 x 5/32 dia. music wire
- 1 — 36 x 7/32 dia. music wire
- 1 — 36 x 1/4 o.d. brass tube
- 1 — 36 x 17/64 o.d. brass tube
- 2 — K&S 5/8 x 0.028 x 24 aluminum tubes
- 2 — K&S 9/16 x 0.016 x 24 aluminum tubes
- 1 — True Turn CO4500, 4-1/2" P-51 Spinner
- 21 — Robart Super Hinge Points
- 14 — Large Klett hinges
- 14 — Du-Bro #158 Steel Landing Gear Straps
- 60 inches — Proctor #217B 1/8" Flat Flying Wire
- 4 — Du-Bro #166 Nose Gear Steering Arms
- 18 — Du-Bro #303 Solder Rod Ends
- 10 — Du-Bro 4-40 Threaded Rod Ends
- 10 — Du-Bro #145 30" 4-40 Threaded Rods
- 4 — Micro Fasteners 4-40 x 1 Socket Head Screws, drilled for safety wire
- 1 — Sullivan S861 Tail Wheel Bracket
- 1 — DGA #103 1/3 Scale Model Pilot Kit
- 1 — Du-Bro 24 oz. Fuel Tank, #424
- 1 pair — Williams Bros. Golden Age wheels, 6-1/2" dia.
- Plus misc. other common hardware store and hobby shop stuff.

sticks and CA glue. This holds everything together while soldering.

Wrap the joints where the music wire meets brass tube with clean copper wire. Add a couple of small washers and a 1.5" diameter fender washer. Use a wooden block to hold the fender washer perpendicular to the axle. Apply solder paste. Solder everything together with a large iron or torch.

Press-fit brass tube bushings into the Williams Bros. wheels. Grease the axle before final assembly. This will prevent the wheels from chattering, and it will provide straighter ground tracking.

Insert a 1/4" brass tube inside the axle. Slip a Williams Bros. wheel onto the axle, add another fender washer and wheel collar. Drill a 1/16" hole at least 1/8" beyond the wheel collar. This hole will accommodate the cotter pin which holds the lift wire bracket. Insert a cotter pin in this hole so that the inner brass tube can't move, then drill a similar hole in the other end of the axle. Cut both brass tubes at least 1/8" beyond the cotter pin hole.

Cut a length of 7/32" music wire whose length is slightly shorter than the distance between the two cotter pin holes. Insert this music wire into the axle. This combination of brass tubes and music wire is very strong.

After years of flight, it is expected that the holes in the axle will become overly enlarged from wear. When this happens, replace the **inner** brass tube.

Complete the landing gear by enclosing the wire and axle in ply and balsa fairings. The patterns are shown on the plans. Glue together with epoxy, holding everything in place with oodles of clothespins and C-clamps. Round the leading edges and taper the trailing edges.

Wrap the landing gear fairings in glass cloth or Koverall. For extra scale detailing and strength, add Epoxy Plus fillets at the axle-strut-fender washer joint.

Apply filler and primer to the landing gear at this point -- it is easier to do it now than when the landing gear is attached to the fuselage. I recommend a nitrate dope base followed by several coats of Sig Sanding Sealer, sanding well between each coat.

We are now ready to attach the landing gear to ply formers F6 lower and F10 lower. Make 3/16" ply supports by using the landing gear wire as a pattern. This assures a perfect fit. Slow-set epoxy the supports to the

formers clamped with C-clamps. Before the epoxy sets, verify that the axle is exactly parallel to the tops of the formers. This can be done by setting the whole business upside down on a flat surface and measuring the height of the axle ends above the surface.

Secure the music wire in the formers with Du-Bro landing gear straps. Substitute longer screws so that they extend through the formers.

The landing gear is now ready to be installed in the fuselage.

Tail:

The completed and covered tail is required early in the fuselage construction, so you might as well build it now while there's room on your workbench.

Begin with the elevator horn. It is two heavy-duty nose gear steering arms on 5/32" music wire. Two arms are used for strength and redundancy. After the plane is assembled, the horns will be inaccessible. The steering arms lean forward slightly in order to not bump into F18 during full up-elevator. File a flat spot on the wire where the set-screws will connect. Apply permanent (blue) Loctite to the set-screws and the flat spots during assembly.

Assemble a Dave Brown fiberglass elevator pushrod. Use two 2-56 threaded clevises at the rear end. Adjust the clevises so that the pushrod will run down the middle of the fuselage. Secure the clevises with jam nuts.

Photocopy the stabilizer with the copier set on extra dark. Lay the copy face down on 1/16" sheet balsa and transfer the ink with a hot iron. Cut the outline and pin it to a flat surface. Assemble the parts over the locations marked on the wood.

Make a rib template from hobby shop K&S brass angle stock. Shape the angle stock per the stab rib pattern shown on the plans. Insert lengths of 1/8" x 1/4" into the template and cut to shape with an X-Acto knife. This rough-cuts the leading edge of each stab rib.

After the glue has dried, mark the location of each rib on the leading and trailing edges, turn over and pin the stab down. Using the marks, assemble the bottom side of the stab. Top and bottom are the same except for a 1/4" sq. which will rest on F17. Sand the ribs to final shape with a large sanding block. Round the leading edge.

Drill holes in the trailing edge for the Robart hinge points.

Drill the holes in the trailing edge for the flying wire fittings. Soak the wood around the holes with CA to harden the wood in this area.

The elevator is built using the same method as the stab. After rounding the leading edge, route out the hinge holes and trial-fit the hinges. They should swing at least 45° in each direction without binding. Note that the hinge point is recessed well into the elevator's leading edge. Epoxy the Robart hinges into the elevator. Trial-fit it to the stab and sand the elevator and stab with a large sanding block so that the elevator is flush with the stab.

Recess the elevator horn assembly into the elevator and epoxy it well. Use Epoxy Plus to blend the horn wire into the elevator edge.

The fin and rudder construction is exactly the same as the stab and elevator except for the rudder horn and rudder fairing.

After assembling the rudder, plane the rudder's 1/2" sheet fairing base to taper from leading edge to trailing edge. The base must be flat. After planing it, sand it to perfect flatness with a sanding block.

Round the edges of the fin and rudder, fit the hinges, and epoxy the rudder horn in place. Don't add the rudder fairing at this time; it will be added after the fin and rudder are attached to the fuselage.

Attach the rudder to the fin by epoxying the hinges in place. Assemble the elevator to the stab. Cover the fin, rudder, stab and elevator. Add a coat of primer. The covered stab and elevator should weigh approximately 8 ounces at this point. Put them aside for later assembly to the fuselage.

Lower Fuselage:

The first step in fuselage construction is to install the engine.

Cut the engine mount from 3/8" ply. This is pretty thick stuff, needed for strength and rigidity because the mighty Saito 150 engine produces a mighty amount of vibration. To lighten it, we cut some holes and fill them with soft balsa. Fit the engine now, attaching it with bolts and blind nuts.

Note the oddly-shaped cutout in the engine mount underneath the carb. This opening is necessary for unobstructed airflow into the carb. I found that the carburetor cannot breathe properly without this opening, so don't omit it.

The fuselage will be assembled upside down over the plans on a flat surface. Remove the engine from the mount and place the engine mount on the plans, inverted.

Lay the 1/4" sq. crutch on the plans. Don't pin it.

Glue F6 and F10 formers with landing gear attached to the crutch. Glue all the other lower fuselage formers in place. Add the tail skid support to F18, then cut and glue the 1/4" crutch crosspieces in place.

Add the 1/4" nose stringers and the 3/8" x 1/8" keel stringer. Epoxy the wing ribs R1 and R2 to F8 and F12.

Remove the fuselage as completed so far and place it on the waxed paper covered floor for alignment with the wings. (We'll need lots of room for the next step.)

Cut the aluminum fuselage tubes about 1/4" oversize. Roughen with sandpaper and slip them into the wing tube holes in R2. Insert the inner aluminum tubes in place and insert the wings onto them. If a tight-fit, remove and file the holes in R2 for a looser fit. Assemble the wings to the fuselage, supporting the wings 1-1/2" at rib W7a (see diagram on plans). Spot-glue the fuselage tubes in place, remove the wings and inner tubes. Then glue the inner tubes well to the formers and R2s with gobs of Epoxy Plus or other thick epoxy.

Add 3/32" sheeting on the nose, wing roots, around the landing gear struts and the rear. To make the balsa sheet flexible, rub very hot water into the outside of the balsa sheet and bend it with your fingers. Don't wet both sides or else it will crack when dry. Glue in place with yellow Elmers glue while still wet.

The leading edge of the wing root has a curvature too sharp for sheeting, so fill it with a small balsa block that is cut to shape before gluing in place.

Remove the fuselage from the building board and set it upright on its landing gear. Complete the sheeting of the upper surface of the wing root.

Upper Fuselage:

This is the most accessible the inside of the fuselage will ever be, so we take this opportunity to install the radio and engine stuff. After the fuselage is complete, the only access to the interior of the fuselage is through the hatch which is very narrow. The hatch opening is adequate for maintenance, but not for initial installation, so <u>all radio gear must be installed before the upper half of the fuselage is built</u>.

Reinstall the engine and mount the tank. Glue servo tray rails between F8 and F10. Install the throttle, elevator, and rudder servos. Make a music wire pushrod to the carb. Route the aileron servo and flap servo connectors through the holes in the wing roots. Install a plastic tube on the fuselage

crutch that runs towards the tail. Push the antenna into it; this makes replacement easy. Spot-glue all electrical cables in place. The radio switch and charging jack remain inside, accessible through the hatch.

Note that the rear of the tank is visible through the hatch. It will be possible to see how much fuel remains in the tank even when the engine is running!

Epoxy the 1/8" ply heat shield in place. This device serves two purposes: it prevents heat from the exhaust system from reaching the fuel tank and it provides vertical support for the engine bearer.

Fashion a throttle bellcrank from two nose wheel arms to transition the throttle pushrod to the carb and install it behind the carb.

Cover the front surface of F12 (rear wall of cockpit) with white MonoKote. Glue all the remaining fuselage formers in place. Add the 1/4" sq. stringers to support them.

Install all cockpit details at this point -- before the smaller stringers are installed. Use brown shoelaces for the shoulder straps. For cockpit details, follow the photo set from Bob Banka's Scale Model Research.

Install all of the smaller stringers. Each stringer should protrude 3/32" beyond each former -- measure with a scrap of 3/32" balsa. After all stringers are installed, verify that they form a uniform support for the covering by stretching a strip of masking tape, sticky side out, vertically over the stringers -- this reveals how the fabric will lay on the stringers. Plane or sand away any non-uniformity in stringer height.

Stain the wood inside the cockpit with light wood stain. Install the dummy pilot with Velcro tape on each shoulder and the back of his head, then remove him to be reinstalled before flight.

Cover the engine bearer and the front of former F6 with Saran Wrap or other plastic to prevent glue sticking to them. Then assemble the cowl in place. Trim the cowl formers as necessary so that they clear the tank, fuel lines, etc. Note how F4 is keyed to dowel rods in F6; and F1 is attached to hardwood blocks in the engine bearer with 1/4" nylon bolts.

Rough-cut the nose bowl block and taper the inside to match cowl former F2. Sand the inside to exact shape before gluing the nose bowl in place. Fill the remainder of the cowl in front of the engine with balsa blocks and rough-cut to shape. Sheet the remainder of the cowl with 3/32" balsa. We shall return to the cowl after fitting the tail. There is a close connection -- bear with me.

The entire tail assembly should have been covered by now with Koverall or other fabric, shrunk tight and primed with nitrate dope or other primer. Fit the stab to the stab saddle. Verify that it is exactly parallel with the wing tubes. If not, shim or trim as necessary. Connect the elevator pushrod to the dual elevator horns and epoxy the stab and elevator in place.

Now epoxy the fin and its attached rudder in place. Verify that it is exactly perpendicular to the stab.

Make rudder cables from Proctor pull-pull wire with a fixed clevis at the rudder end and an adjustable clevis at the servo end. Install with just enough tension to remove slack. If you can twang it like a guitar string, it's too tight.

The balsa fairings for the lower part of the rudder can now be fitted to the rudder. Plane and sand them to shape before gluing them in place. It helps to use Bob Banka's photos of the full-sized Pete to see the degree of rounding required. Hollow the insides with a woodcarver's gouge to reduce weight.

And now comes the best part! Add all the remaining stringers. Use a scrap of 3/32" balsa to ensure that each stringer protrudes 3/32" beyond each former. Test with masking tape to find uneven stringer heights and plane them down, if necessary.

Note that the fuselage is not very rigid at this point and is very easy to twist. No plane can fly very well with a twisty tail like that! Not to worry. When the fabric is in place and painted, the fuselage will be very rigid.

We return to the nose.

Cover the hatch area with Saran Wrap and place the hatch formers in place. Glue the 1/4" stringers in place. Sheet the hatch. Note that the forward sheeting extends over former F6 to abut the cowl sheeting, but is not glued to F6. Then sheet the fuselage below the hatch.

The rearmost former in the hatch holds the only instrument clearly visible from the outside. It's a model T fuel gauge stuck in the pilot's face. Evidently, Benny Howard once had a fuel starvation problem that he was determined not to repeat. Its bezel is a #10 aluminum finishing washer.

Remove the hatch and sheet the fuselage area below the hatch.

Sheet the turtledeck behind the headrest. Fill the stringers at the tail with 3/32" sheet to support the fabric.

The dummy engine is made from 1/8" sheet balsa with four half Williams Bros. cylinders glued to it. A rounded balsa block simulates the crankcase below the cylinders, cut out for cooling air from the engine. The ignition coil is the base of a flashlight bulb with a wire soldered onto it. The carb and manifold is more sheet balsa. Four exhaust holes are cut in the top of the cowl. The exhaust pipes are styrene tubes purchased from the model railroad section of your local hobby shop. The dummy carb intake tube is a 1/2" model rocket body.

Build the dummy engine as a separate unit. Install it in the cowl after both are painted.

I have found that once the Saito engine is broken in and its carburetor properly adjusted, no further adjustment of the carb is necessary unless something changes: new fuel type, etc. So a needle valve extension is not necessary. To adjust the carb, remove the cowl.

A remote Headlock connector is positioned on the engine bearer below the opening on the right side of the cowl. A long Du-Bro glow plug connector is used to light the glow plug through the cowl opening. Onboard glow is not necessary.

(To be continued)

References

Paul Matt's Scale Airplane Drawings, Vol. 2, Sunshine House -- 5-view drawings with color and markings.

'98 U.S. Scalemasters Champs, #49 (video of model Pete in flight). Hansen Scale Aviation Videos, 10807 S.E. Stacy Ct., Portland, OR 97266.

Video #53. Re-enactment of Benny Howard's 1930 airshow routine by the model Pete shown in this article. Hansen Scale Aviation Videos. 10807 S.E. Stacy Ct., Portland, OR 97266.

American Air Racing Society c/o Rudy Profant, 4060 W. 158th St., Cleveland, OH 44135 -- internal structural drawings, 8 x 10 photos.

National Air and Space Museum, Archives-Stell-MRC322, Washington, D.C. 20560. 8" x 10" B&W photos of original Pete, 1B-06836 through 06838.

Scale Rib Stitching -- Six Easy Methods, RCM, May 1998.

Foto-Paak #5083/48. Bob Banka's Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626 -- color photos of modern, restored Pete.

"Pete & Repeat," Bill Turner, *Sport Aviation*, 28 May, 1994 -- history and photos.

"Pete's Nine Lives," Bill Turner, *Custom Planes*, June 1998 -- more history and photos.

The Golden Age of Air Racing, Schmid & Weaver, EAA Aviation Foundation, 1991 -- more history and photos.

Micro Fasteners, 110 Hillcrest Road, Flemington, NJ 08822

microf@blast.net

-- #SCA0416DR 4-40 socket head screws drilled for safety wire.

DGA Designs, 135 E. Main Street, Phelps, NY 14532 -- pilot figure.

K&S Special Shapes Catalog Division, P.O. Box 7487, Romeoville, IL 60446-0487 -- aluminum tubing for wing tubes.

True Turn, ROMCO Manufacturing, Inc., P.O. Box 836, South Houston, TX 77587 -- flying spinner.

Jim Sandquist, 507 Linden Drive, St. Joseph, IL 61873, **j.sandquist@juno.com**

-- static display spinner.

✈