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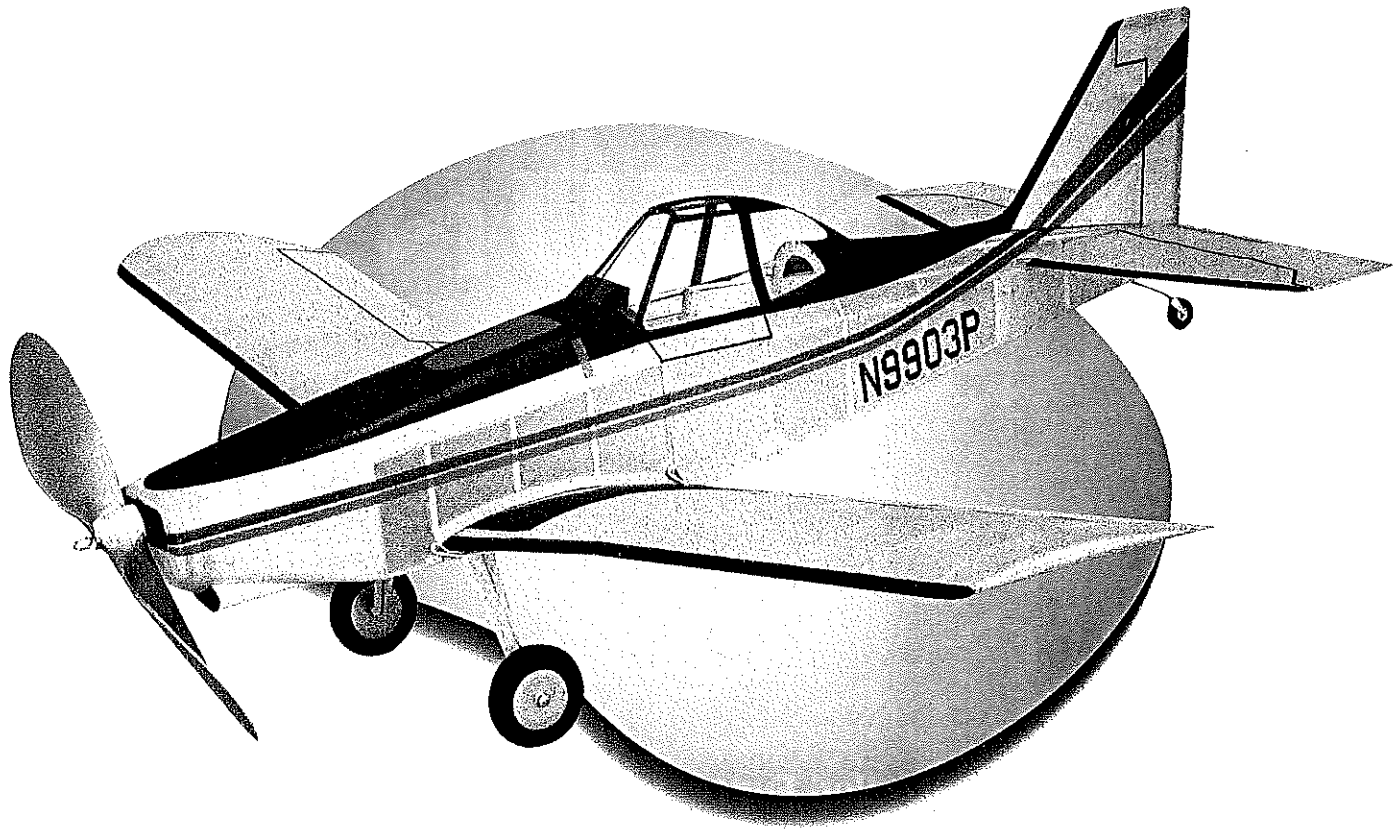



# PIPER PAWNEE BRAVE

Earl Stahl

## We are honored to present the latest design by a true modeling legend and a master of his craft

**AGRICULTURAL AIRCRAFT** are playing an increasingly important role in helping to meet the nutritional requirements for the world's burgeoning population. With massive capability to distribute seed, fight the destructive actions of pests, and nourish developing crops, they are in service about the globe.

The Piper Pawnee Brave was the last of the aerial applicators produced by Piper. It was designed to distribute a broad range of farming necessities at affordable costs; to provide improved safety and comfort for the pilot; and to be rugged, with low maintenance requirements while away from base working the fields.

Nine hundred thirty-eight were made before production was terminated in 1983. Piper had fallen victim of economic hard times as the small-airplane manufacturing industry collapsed in the United States.

The Brave's configuration is excellent for a rubber-powered Flying Scale model. Except for an enlarged horizontal tail and increased dihedral, this is a faithful representation of 285 hp Continental engine powered models of early production. Later editions used more powerful Lycoming engines with slightly changed cowl shapes. Of course, to meet our objective of a trim-appearing, lightweight craft, the various appendages added to the wing and underbelly for aerial applications are not simulated. The prototype aircraft, early in the test program, flew in this "clean" configuration.

### CONSTRUCTION

This is a low-tech model—the sort remaining popular with a host of fun-flyers. In fact, had the Brave been conceived half-a-century ago, I likely would have designed and flown a model very similar to this project. Though easy to build, the large cockpit enclosure and upswept wingtips may present a new challenge to some. Select balsa with an eye to strength where required and light weight where possible. Any of the popular adhesives may be used; I still prefer the long-popular cellulose cements for most of the joints.

**Fuselage:** Construction is conventional. Assemble the primary fuselage structure side frames, one atop the other, using firm longerons and lightweight crossmembers. Accurately shape and position the low density 3/32 sheet members of the side

rames where the fuselage and wing mate, o establish the desired wing incidence ngle.

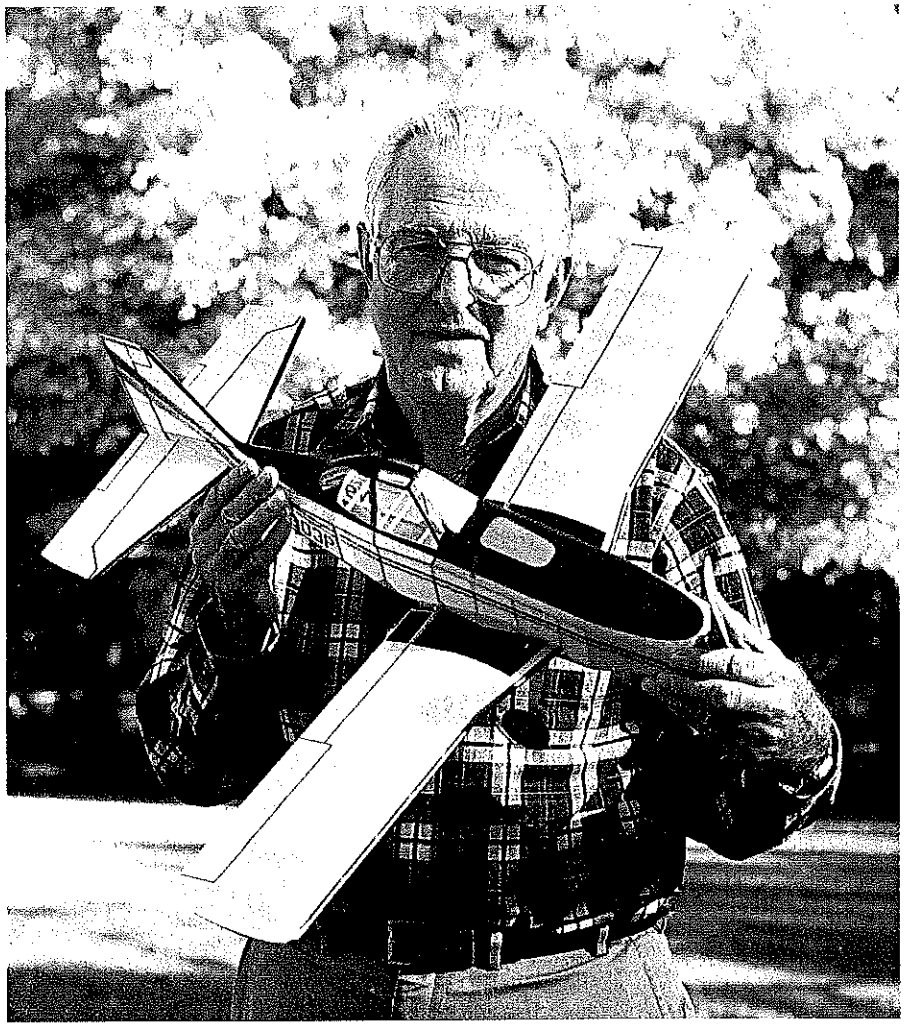
Place the two side frames inverted over ne aft top view (station F-7 to tail post) fter having first cracked top and bottom ongerons at F-3 and F-8 so the sides will onform to the angular contour of the irplane's body. Firmly glue the cracked ongerons to reestablish their structural ntegrity.

Once the basic frame is complete, glue he fuselage formers in place and add the tringers. Use a long, straight ¾ wide pline with fine sandpaper glued to the face o touch up any irregularities in the shapes r positioning of formers before gluing ow-density 1/32 sheet to the upper forward uselage and nose. With several narrow ieces and care, I covered the contoured ower nose with 1/32 material; others may ind it preferable to fill in this section of he nose with thicker sheet or the popular lue foam.

Notice the triangular 1/16 sheet orizontal tail mounts at the rear of the uselage. Cut and position these, right and eft, with care, since they will establish the ncidence angle of the tail when it is later lued to place.

Four pieces of 1/8 sheet balsa glued ogether, crossgrained, are used to form the ose. Cut the square holes to receive the emovable nose plug, as well as the imulated air intake for the engine, before oining the parts. Glue the nose block to the orward sides of station F-1.

Carefully trim (and with a sanding lock, dress) the nose and adjacent sheet-overed areas to the configuration shown.



**The master, Earl Stahl, and his latest creation.**

Photos provided by the author Graphic Design by Carla Kunz

## PIPER POWNEE BRAVE

**Type:** FF Rubber Scale

**Wingspan:** 30½ inches

**Rubber Motor:** Eight strands 1/8 rubber 19 inches long

**Flying Weight:** 2.8 ounces

**Construction:** Built-up

**Covering/finish:** Japanese tissue/nitrate dope

**Off on a test hop. Author feels that the Brave could make a good competition model, though his version is intended for relaxed sport flying.**

An alternate approach is to make the entire nose block (with plastic thrust button, wire shaft, and propeller, ahead of station F-1) removable. To me, this otherwise wholly practical method is visually less attractive on a carefully crafted model.

**Tail Surfaces:** A lightweight yet sturdy, warp-resistant tail assembly should be the goal. The horizontal and vertical tails are made similarly, except for some material sizes. Leading and trailing edges of the horizontal tail are light balsa while the 3/32 square spar should be a firm, straight-grain strip. The ribs are also light material, overlaid top and bottom with 1/16 square low-density strips.

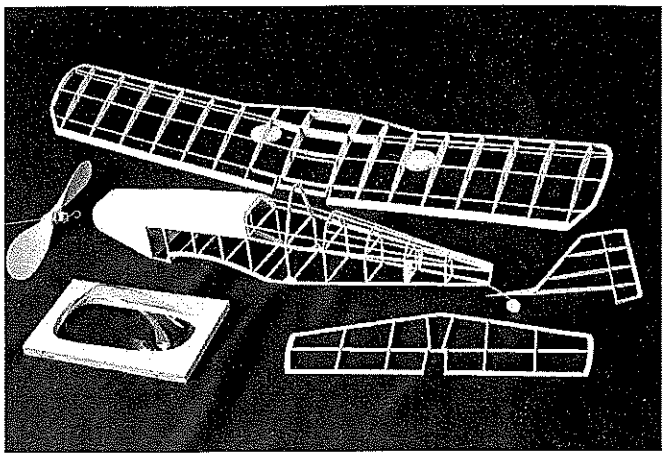
Shape the leading and trailing edges as well as the ribs to the symmetrical contour shown; a sanding spline makes the task easy. The vertical tail with its dorsal fin is fabricated in a similar manner.

**Wing:** To ease storage or transportation problems, the wing of the Brave can be made removable by using two unobtrusive office rubber bands looped over ends of bamboo splints extending from the fuselage sides and then under the wing. (If a permanent mount is desired, the wing can simply be glued in place after covering.) In either case, construction of the wing and landing gear is the same. Except for 1/16 thick ribs W-1, all others are cut from 1/20 sheet balsa. Leading and trailing edges are medium-grade, straight material; the 1/16 square spars should be very firm, straight-grain balsa strips.

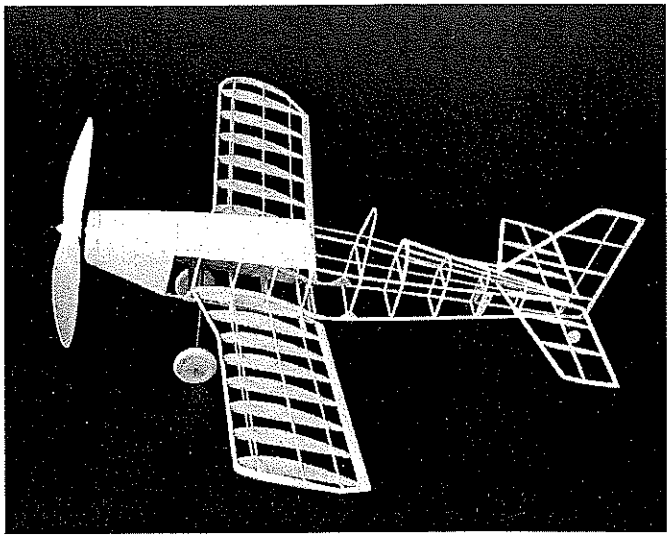
It is highly desirable that the upswept wing tips be kept very light. On the original, each was fashioned from laminations of three low-density strips. This can best be done by making a wooden form of the inside curvature of the tip. After soaking 1/16 x 3/8 x 8 pieces in a mixture of water and ammonia, bend three tightly around the form, holding in place with tape or rubber bands until dry (overnight). Coat the mating surfaces with white glue, then reposition against the form, (again, holding them firmly together) until the glue has set.

Assemble the right and left wing panels, including the yet-bulky tips, atop the plan. Allow the forward top 1/16 square spar of each panel to extend inboard from rib W-1 so it can later be glued to center section part CS-3 for enhanced strength. Note on the model front view, between ribs W-1 and W-2, 1/16 sheet with the grain oriented vertically is glued between the top and bottom front spars.

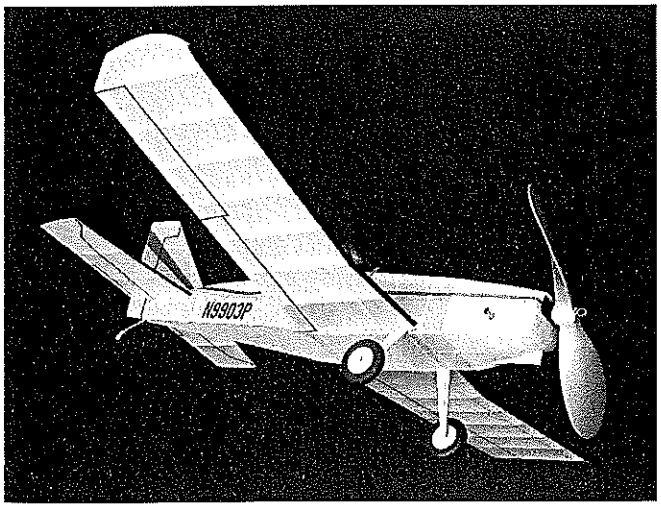
While the wings remain in place over the plan, roughly trim the upper edge of the tips to conform, leading edge to trailing edge, to the airfoil shape of the wing's upper surface. For this task a one- to two-inch-long strip of sandpaper glued to the end of a wooden spline will help bring the tip to final upper curvature. Once the bare end of the spline rests lightly on the inboard ribs (always



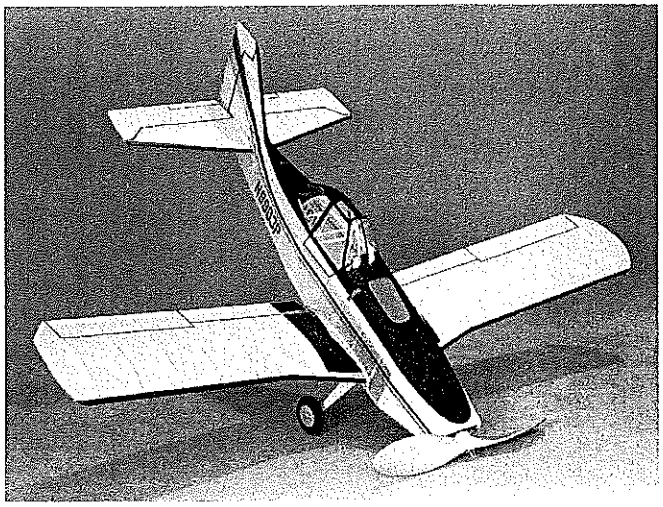
**Classic framework for this stick-and-tissue model—elegant, yet functional. Text details procedure to make canopy.**



**Structure is ready to cover. Author prefers time-honored Japanese tissue covering with clear dope and tissue trim.**

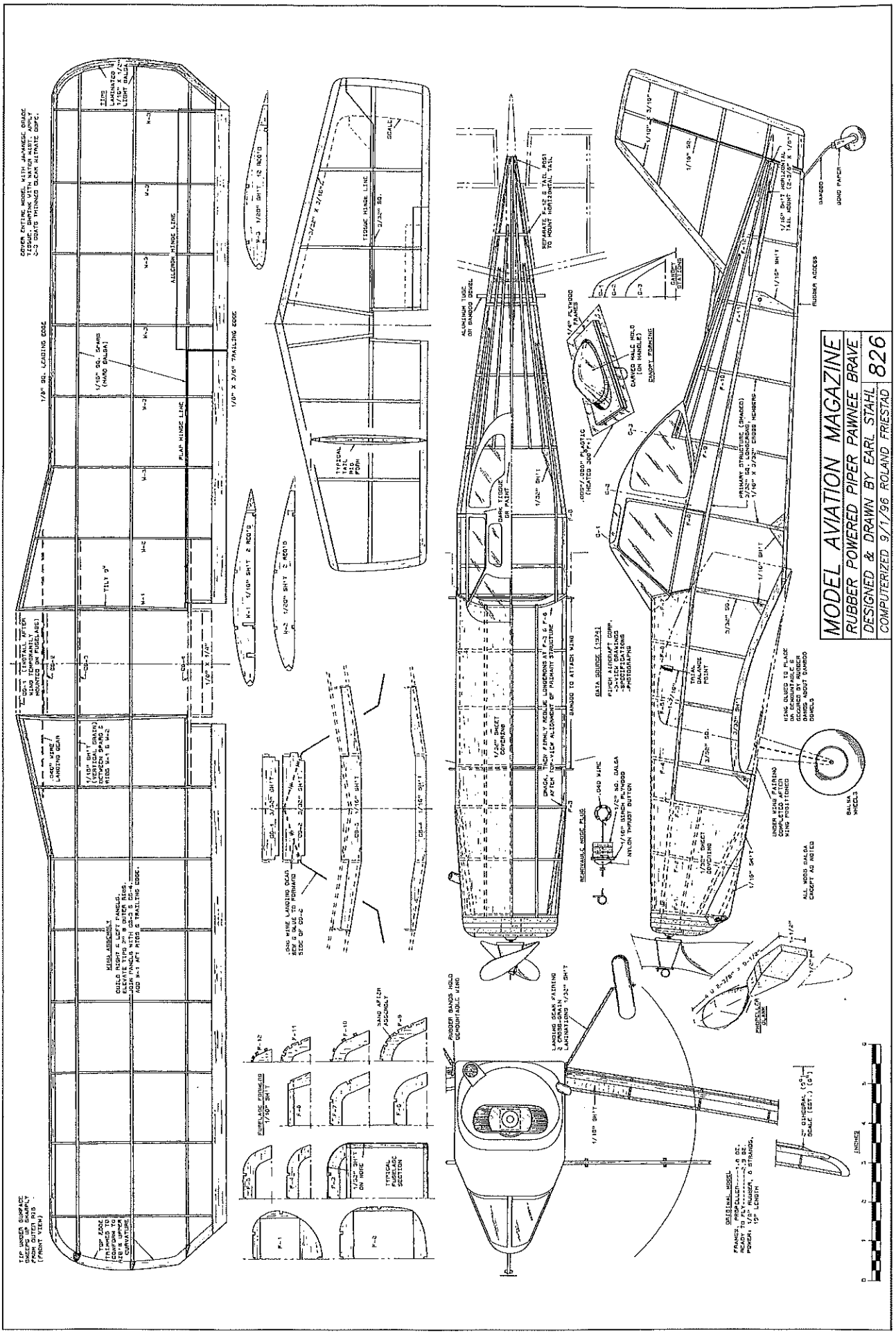



**Landing gear struts are cross-grained 1/32 sheet. Tail wheel support is formed from bamboo. Wheels are medium balsa.**



**Nitrate dope was used to attach the tissue to the structure. After trim was added, two coats of thinned dope were applied.**

## Full-Size Plans Available—see page 192



oriented parallel to the leading and trailing edge), the goal should have been reached. Lift the wing panels from the plan and remove excess material from the tip undersides. Extend the two short sections of the bottom spars from the outer ribs to the tips.

Final assembly of the wing begins over the plan. Parts CS-3 and CS-4 are used. Elevate the outermost ribs two inches as depicted on the front view. Before landing gear support CS-2 is attached, it may be desirable to form the .046 diameter music-wire gear and attach it to the forward side with thread and glue. Incidentally, the cambered axle angles depict the inflight position of the gear and wheels of the full-size aircraft.

The wing must be lifted from the plan to fix CS-2 to place. At this stage I recommend that the wing be carefully positioned and lightly glued to the fuselage so the underwing fairing can be completed using item CS-1, 3/32 square longeron extensions, and the stud trailing edge materials.

**Cockpit enclosure:** Cockpit canopies are prominent visual features of modern agricultural aircraft. Although it was somewhat time-consuming to prepare a male mold and holding frame for the clear plastic, making a realistic, lightweight enclosure for this model was a relatively easy task. I'm told some use a block of easily carved balsa to create a mold; I carved mine from basswood, which was fitted with a three-inch-long dowel handle.

The plan (top) and side views of the plank canopy were shaped first; then the cross-sectional shape was achieved by carving away the excess to match the station shapes shown. The lower portion of the original male mold was made about ¼-inch deeper than the stations depict, so there was a little excess for precise trimming when the canopy was fitted to the covered fuselage.

It is important to carefully fair and smooth the mold before attempting to reproduce the shape. Toward that end, the original form was coated with three applications of clear nitrate dope, sanded with fine-grade paper between coats.

To hold the clear plastic sheet into which the mold was pressed, two identical frames of ¼ plywood (scrap or construction-grade) were made. The canopy top view, enlarged about ¼ inch at each side and ½ inch at front and back, was cut from the interior of each frame with a coping saw. Edges of the cutouts were sanded smooth.

To keep the model light .005 clear plastic sheet was used. To produce a canopy that conforms to the mold shape, the plastic must be held tightly between the two frames; I used an abundance of short nails (perhaps 20) to accomplish the firm grip.

Preheat an oven to about 350° F; our electric kitchen oven was ideal. Use a kitchen utensil such as a cylindrical metal pot, deeper than the canopy, to support the frame with plastic while it is on an oven shelf. Once the plastic is hot enough to droop noticeably in the oven environment, quickly remove the frame from the oven, using hand protection, support it on another utensil, and press the properly positioned mold slowly but firmly into the plastic.

If resistance becomes too great, return the plastic to the heat source and try again. My first attempt was moderately successful; the second was better and is the one pictured on the model. It weighs about 2½ grams.

**Propeller Unit:** Without conclusive proof that they are best, I always carve my props—remaining aware that, as a minimum, further experimenting with pitch and blade profile might be fruitful. Length of my propellers is always as great as landing gear height permits. In any case, I am confident that the prop-blank proportions detailed on the plan can enable a prop of good performance to be produced.

Select a block of hard, straight-grained, homogeneous balsa. Bore a slightly oversize hole for the shaft, using a drill press if available. Accurately shape the blank to the given dimensions; keep the hub width at center about ⅜ inch.

Before starting to carve, I always tack-

glue the blank to a work board, using cement that can later be dissolved with acetone or lacquer thinner. A sharp knife will do, but a craftsman's chisel or gouge is better to remove material from the blank to become the back face.

With the blank firmly attached to a board in this manner, the back faces can be carved to identical, slightly undercambered shapes, and pitch angles can be conveniently checked at several stations. Use thin splines with several grades of abrasive roughness to fair the back from hub to tips. Remove the blank from the work board and use a sharp knife to reduce the front faces to airfoil shape, as well as to taper blade thickness from hub to tips.

At this point use a knife to reduce the depth of the hub, front and back, as illustrated on the plan side view. Shape one blade to a smooth profile with a rounded tip. Make a paper pattern of that blade to replicate on the other half. Balance the propeller by carefully removing material from the heavy side.

On the original I cemented a 5/8 diameter 1/16 plywood disk to the back of the hub and added carved balsa segments to the hub sides to fashion a truncated spinner. Three or four coats of nitrate dope or lacquer, sanded between applications, produces a smooth, hard finish. A coat or two on a light blade can be used to restore balance.

The removable nose plug assembly is detailed on the plan; the front shape of the 1/16 plywood face is illustrated on the front view. Be sure to incorporate your favorite freewheeling device so the prop can spin effortlessly as the model glides home. A simple rachet type was used successfully on the original.

**Covering:** Skillful covering, combined with accurate or tasteful decorative trim, greatly influences a model's visual appeal. Today, truly realistic replicas with airbrushed finishes are widely seen. And although they are often somewhat heavier, many fly so well that builders often helplessly see them soar away in the embrace of Hung, the ruler of thermals.

Despite the realism of pigmented paint,

I consider the often-gossamer appearance of clear-doped colored tissue, revealing some structure beneath, an artform of preference. Take your pick—you can't go wrong.

In either case, a structure prepared by careful sandpapering is mandatory. With its lack of complex contours, this is an easy model to cover. Thinned nitrate dope was used to bond the colored tissue to the frames. Where individual pieces of tissue meet, they should be barely lapped to enhance final appearance.

A suggestion: refrain from covering the aft top section of fuselage until the horizontal tail (covered and watershrunk) is mounted. To do this, make a cut across the tail post, as well as near the base of former F-12. The rear fuselage stringers can then be eased upward enough to allow the one-piece tail to enter. Once the leading edge and centrally located spar rest on the tapered mount, the tail incidence should be proper. Glue the tail in place and reattach the separated fuselage members.

After the remainder of the fuselage is covered, the tissue covered vertical tail can also be cemented to place. On the original model, license numerals, control-surface outlines, and decorative trim were attached with very thin dope before two coats of half-and-half nitrate and thinner were brushed on.

**Finishing Details:** To effectively represent the appearance of the Brave's spring landing gear struts, two crossgrained laminations of 1/32 sheet balsa with slots along the length of the inner surfaces are used. Fit the slots over the wire struts previously mounted on the wing assembly, securing then with glue, then cover the landing gear legs with tissue or light silk. The wheels can be made from laminations of medium-grade balsa.

With heat (soldering iron, etc.) bend a flat bamboo splint to form a tail wheel support; bond paper can be cut and folded to represent the tail wheel's supporting fork. Details such as the carburetor air intake, exhaust stack, etc. can be improvised from light balsa or foam.

Because the cockpit enclosure is such a prominent feature, care must be exercised

in its preparing and mounting. I represented the non-transparent structural features of the enclosure with dark tissue. To assist in this undertaking, the structure was outlined using a soft pencil on the male mold previously used to form the canopy. After taping the canopy in place over the mold, I cut the dark tissue to match the pencil outlines beneath and carefully bonded the tissue to the plastic by brushing clear nitrate through the tissue.

Where compound curves caused the tissue to not rest tightly on the canopy, a deft slit by a razor blade eliminated the problem. Assuming the plastic enclosure was formed slightly deeper than finished size, as previously recommended, the excess at the base is now trimmed away to precisely fit the adjacent fuselage shape. Once fitted, hold the canopy in position with several tiny strips of masking tape. Then flow a narrow bead of cement around all edges to create a firm bond. I used one of Harry Geyer's Micro Cementeurs loaded with Ambroid.

**Flying:** By now you have invested considerable time and effort in your Brave, so approach the testing phase with care. Eight strands of ⅛ rubber 19 inches long was the power experimentally selected for fun-flying the original.

Before going to the flying field, check the longitudinal balance by supporting the aircraft at the wingtips, 1 7/16 behind the leading edge (about 32% of wing chord). My model required 4½ grams of lead inside the nose at the base of station F-1.

Those of us with the good fortune to have tall grass and soft weeds take advantage of such prize landing spots for shoulder-height test glides. Attentively observe the glides to refine weight adjustments or excessive turning tendencies while seeking a long, smooth descent. By the way, don't energetically throw the model; rather, gently launch it slightly nose-down, wing level, at anticipated glide speed.

If the thrustline and the wing and horizontal tail angles are as specified on the plan, only minor downthrust or right thrust adjustments (at the removable nose plug) should be required. The original trimmed easily for a shallow right turn as it climbs smartly. At various times it makes broad right or left turns in the descending glides.

This stable model, graceful in flight, should make a good competitor if that is the builder's goal. Mine only flies in relatively calm, stable air, since youth has fled from my body—causing me to no longer relish the challenge of breathless, long-distance chases over the river and beyond the woods. ✈

*Earl F. Stahl*
*303 Marlbank Dr.*
*Yorktown VA 23692*