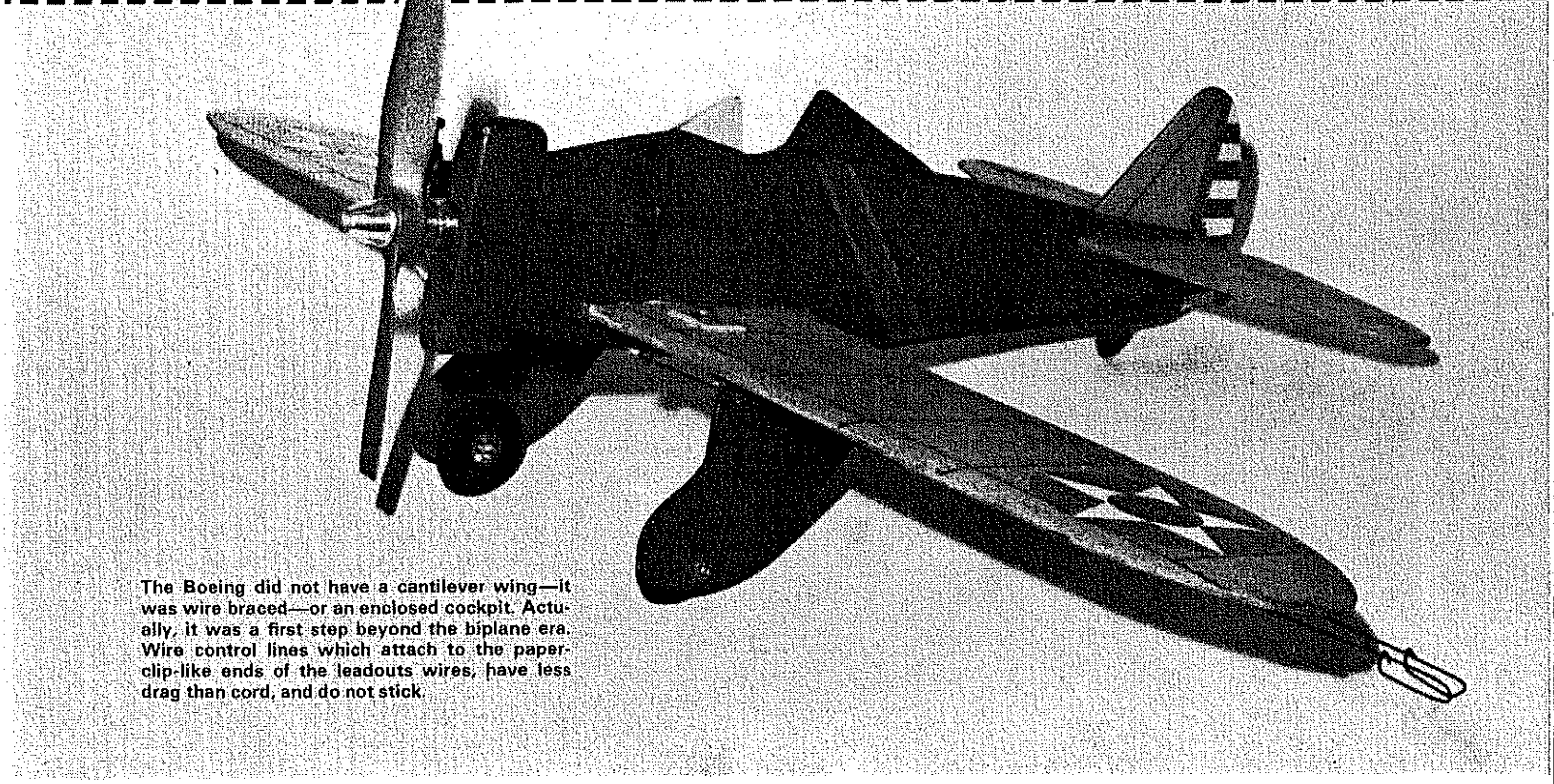
FIGHTERS TWO

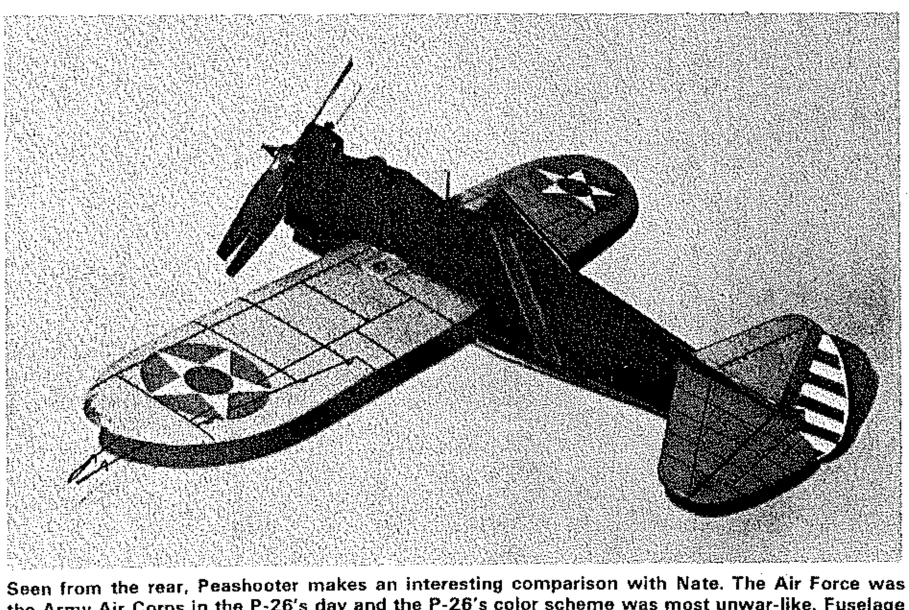


The Boeing did not have a cantilever wing—it was wire braced—or an enclosed cockpit. Actually, it was a first step beyond the biplane era. Wire control lines which attach to the paper-clip-like ends of the leadouts wires, have less drag than cord, and do not stick.

by the P-35, P-36 and P-40, all of which featured internally braced (cantilevered) wings and retractable landing gears.

The Nakajima, KI-27, Type 97 fighter, called "97 sen" by the pilots and nicknamed Nate by the allies, was designed in 1935. Because of its lightness and maneuverability the KI-27 was chosen for duty by the Japanese Army Air Force in the air trials of 1936. The Nate became the JAAF's first-line fighter. Over 3,000 were produced up to the end of the war in 1945.

The KI-27 was first used in combat against Russia in Manchuria, and accounted for most of the 1,252 Soviet aircraft destroyed, for a loss of only about 100 KI-27's. In WW II, it was the JAAF Nates that established early air superiority in the Pacific over Malaya, Indochina, and the Philippines. The Nate was fast and maneuverable but lacked armour protection for the pilot and self-sealing fuel tanks. By 1942, the Nates in combat were replaced by the newer and faster KI-43, Hayabusa (Oscar) of the JAAF, while the Japanese Navy pilots flew Mitsubishi A6M Zeros. The remaining Nates were used as trainers until the end of the war.

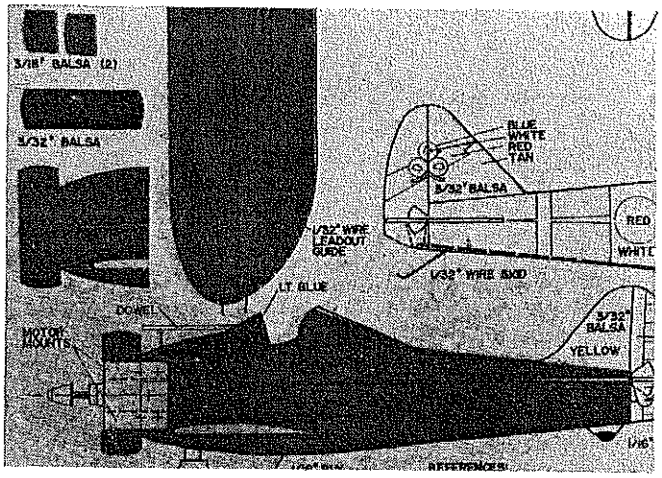


Seen from the rear, Peashooter makes an interesting comparison with Nate. The Air Force was the Army Air Corps in the P-26's day and the P-26's color scheme was most unwar-like. Fuselage was blue, wings and tail bright yellow with highly visible red-and-white stars and rudder stripes.

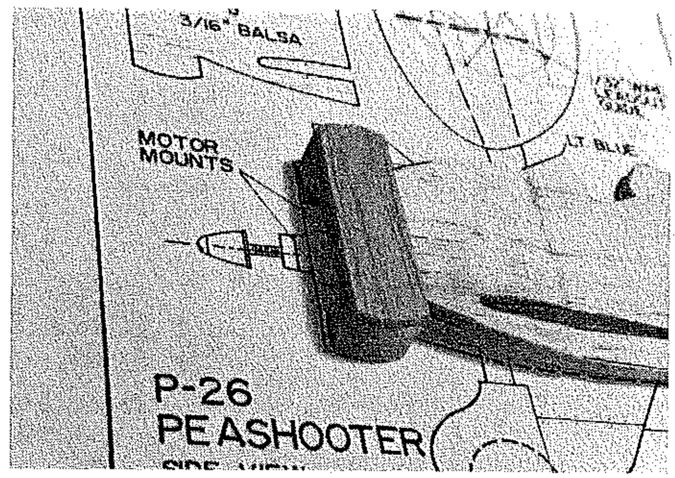
Construction of the KI-27 Nate

Select a light piece of 3/16 × 3 × 36" balsa and cut an 18" length for the wing, an 11¼ length for the fuselage, and two 2½" lengths for parts A and B. Lay the 3 × 18" wing piece over the KI-27 top view on the plan, and note the dotted-line marks by the wing tips. Use these outer marks to position the wing, then mark the wood at the inner marks and draw the wing outline on the wood with a ball-point pen. You will see that the wing is a little wider in the center than the wood, but the piece you cut off at the wing tip will fill the gap. Glue these two slender triangles of wood in place along the back edge of the wing, then round off the wing tips using a small tin can or glass to mark the outlines of the wing tips. Sand the wing to an airfoil shape to match the cross section of the wing on the side view of the plan.

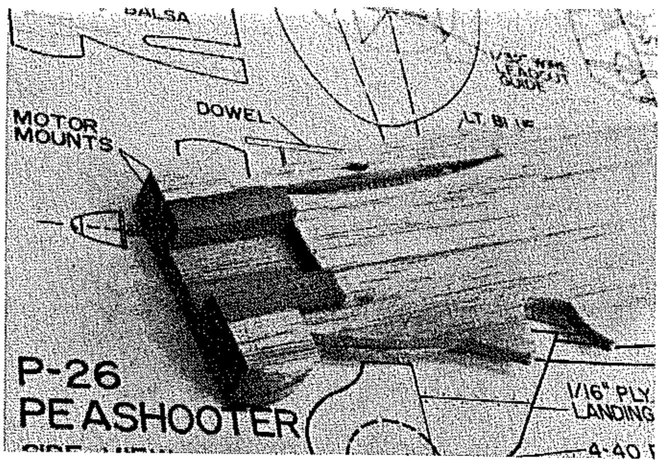
Place the fuselage wood under the plan,



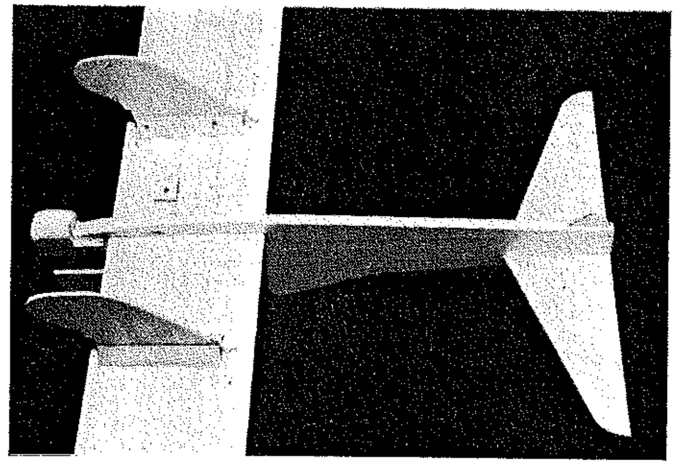
Step 1 in the Peashooter's construction: Mark and cut out the balsa parts, using a pin through the plan to mark the wood—as shown in Step 2 of the Nate construction. Lay parts over plan to check accuracy.



Step 2. Bevel-sand the back edge of part B. Glue part B, then Part A, to the fuselage as shown. The make-believe cowl is quite simple. Note the tapering wedge piece of balsa laminated to fuselage and butted behind the cowl. This piece extends over the wing to strengthen joint.



Step 3. Glue the 3/8" sq. pine motor mounts into the fuselage. Add the two parts C above and below the motor mounts. Round off all the edges with sandpaper. Hole for wing must be accurate—wings slides through it.



Step 4. Cut out the remaining parts and assemble as shown. Note lead-out holes in the plywood landing gear, and the plywood bellcrank mount glued to the wing. The bellcrank itself must be able to rotate freely.

aligning the bottom, front, and back, then pin the plan to the wood. With another pin, go around the fuselage outline sticking the pin through the plan into the wood to mark the outline as shown in the photograph. Be sure to mark around the wing, the slot for the stabilizer, and the motor mounts so that the front of the fuselage is the same as part B. In the same way, mark parts A and B, and cut out. It may be easier to trace over the pin marks with a pen before cutting out the parts. Glue part A onto the left side of the fuselage and part B to the right side. Glue the hardwood motor mounts into the fuselage, then sand the rear portions of parts A and B until they fair into the fuselage side, using the top view of the plan and the photograph as a guide.

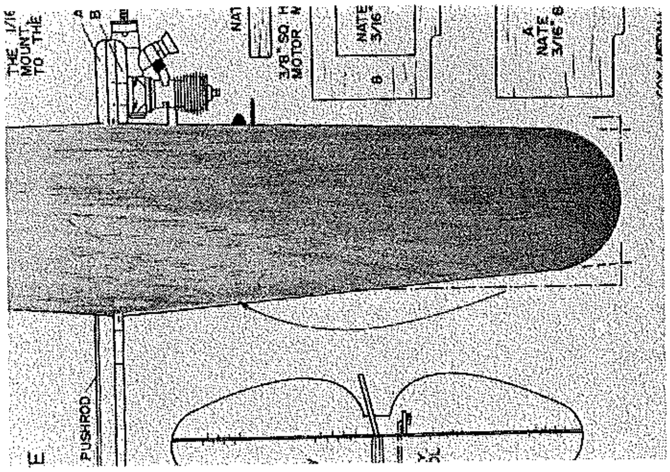
Although not shown on the plan, the models can be built with dihedral to give a more scale-like appearance. The Nate was built with dihedral and flies as well as the straight-winged version. Even with dihedral, the model flies level with the ground, not tilted up as might be expected. If dihedral is desired, cut the wing in half after sanding the airfoil, then bevel the edges of the center joint with a sanding block, and epoxy the wing halves back together, after blocking one tip up about 2" while the glue dries. Glue the wing to the fuselage. Cut out the 3/32" balsa fin and rudder, elevator and stabilizer, again using a pin through the plan to mark the outlines. Glue the stabilizer into the slot in the rear of the fuselage with the hinge line even with the back edge of the fuselage.

From 1/16" plywood, cut out the two wheel covers, the two landing gear mounts, the two bellcrank supports, and the control horn. Bend the landing gear wires from 1/16" piano wire making a right and left side. Drill both the landing gear mounts and the wheel covers with a 1/16" drill, as shown on the plan, so they can be bound to the wire landing gear with a needle and thread as shown in the photograph. The wing must be notched for the wire landing gear under the plywood landing gear mounts. Mark the wing for the notches by pushing the completed landing gear against the wing just hard enough for the wire to dent the wood, then cut out the notches with an X-acto knife. When the landing gear mounts fit evenly against the wing, glue them in place.

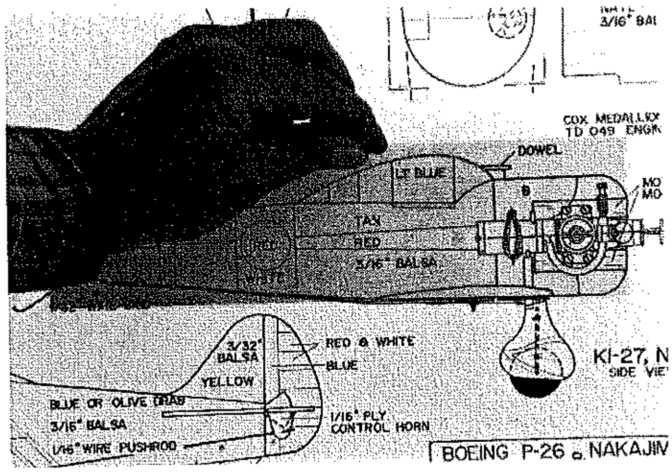
Mark the center of the 1/16" bellcrank mounts on the bottom of the wing, and push a pin up through the wing to mark the top of the wing in the same place. Glue the two 1/16" plywood bellcrank mounts in place, centering the holes over the marks on the wing. When dry, drill through the wing with a 1/8" drill, using the holes in the bellcrank mounts as a guide. Glue the 1/16" plywood control horn onto the bottom of the elevator. The size and shape of the control horn can be seen on the side view of the P-26 on the plan. Make a 1/16" hole in the control horn for the pushrod wire. The model now is ready for final sanding and painting.

Construction of the P-26 Peashooter

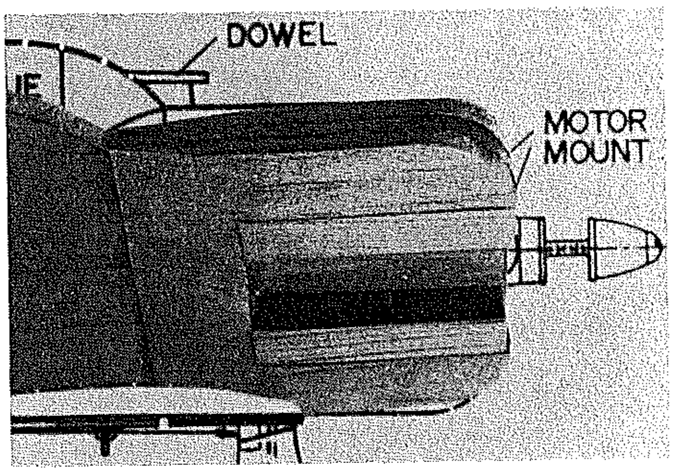
From a piece of light 3/16 × 3 × 36" balsa cut an 18" length for the wing, a 10⅞" for the fuselage and a 2⅝" length for part B. Place the wing piece under the plan and use a pin through the plan to mark the wing tip outlines. Similarly, mark the fuselage outline. Be sure to mark the stabilizer slot cut out, the wing cut out, and around the motor mounts as shown in the photo-



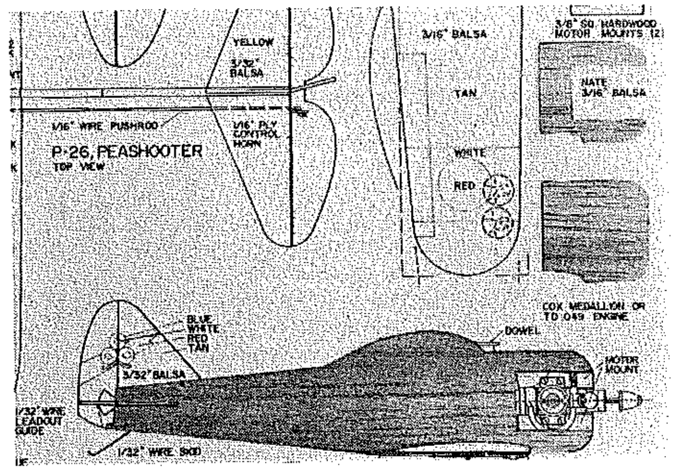
Step 1 in Nate construction. Lay 3/16 x 3 x 18 balsa over plan, using dotted lines as a guide, and mark the tips using the inner lines. Piece cut from back edge of wing tip is glued on in center to fill the gap.



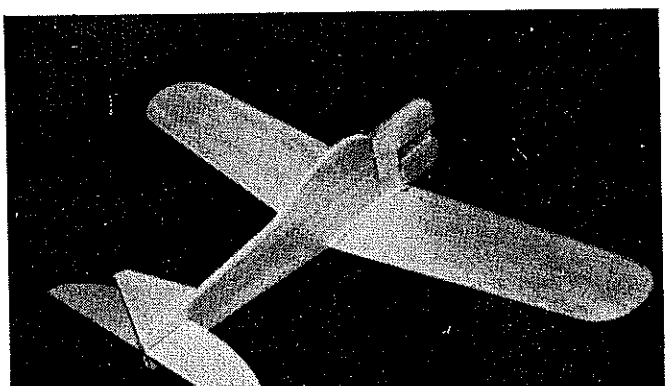
Step 2. Shapes of the wood parts are marked by placing the wood under the plan and marking the outline with a pin pushed through the plan and into the wood. Go over pin marks with a pen making it easier to cut out.



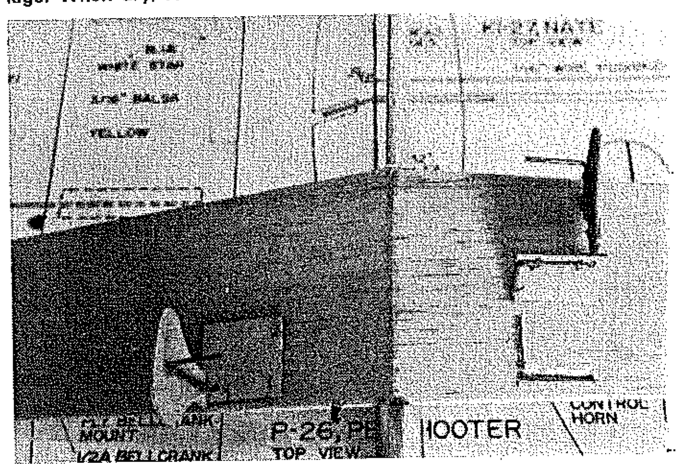
Step 3. Cut out the fuselage parts as shown. Note the cutouts for the wing and stabilizer. The small piece of dowel just forward of the canopy — it shows on plan — depicts a gun sight typical of that period.



Step 4. Bevel the back edges of parts A and B before gluing them to fuselage. Glue the pine or other hardwood motor mounts into the fuselage. When dry, round off all the edges with sandpaper. Very strong.



Step 5. Now things are looking up! Once the wing, stabilizer and fin are glued to the fuselage, one begins to feel that flying fever. Sand all the parts smooth with #220 sandpaper. While the glue is still wet, check alignment of plane over the plan. Also sight on it from front and back. It helps to get stab set true first, then use it as reference.

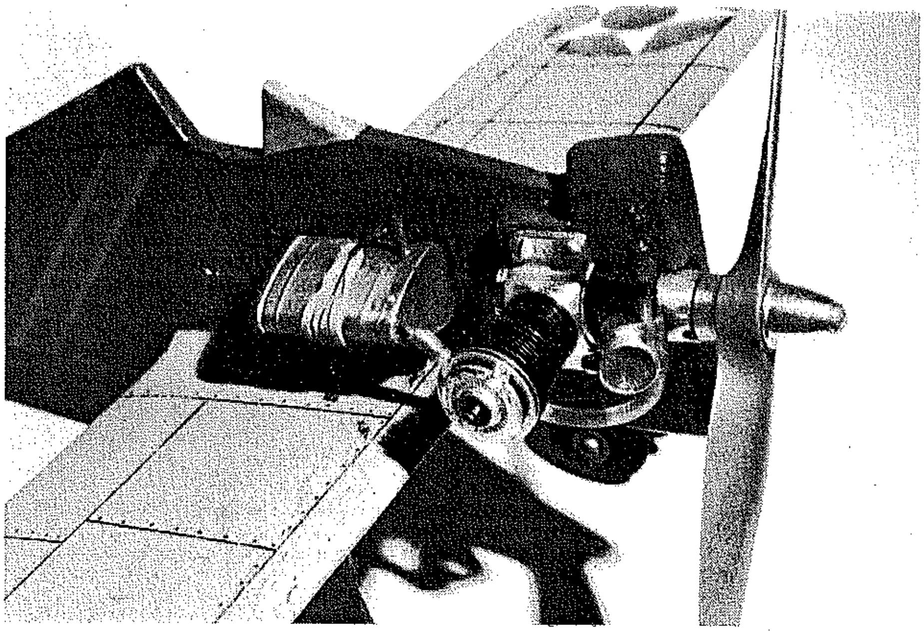


Step 6. Bent wire landing gear is bound to the mounts and wheelcovers with needle and thread run through small holes drilled in the plywood parts. Wing is marked for notch by pressing wire against it. Notch is enlarged with X-Acto knife until gear fits tightly against wing. Glue in place and glue covers to the wire to keep them from twisting.

graph. Go over the pin marks on the wood with a ball-point pen for an easier line to follow when cutting out the parts. From scrap 3/16" balsa cut out two of part C and cut out part A from 3/32" balsa.

First, glue part B to the left side of the fuselage and sand the back edge to fair into the fuselage side. See the top view on the plan and the photographs for details. Glue on part A to simulate the ringed engine cowl. Glue the ⅜" sq. pine (or hardwood) engine mounts into the fuselage, and add parts C to finish the front end. Sand round the endges of the fuselage and cowl.

Sand the wing to airfoil shape to match the cross section of the wing on the side view of the plan. Lay the wing over the plan and mark the center of the wing along the front and back edge to align with the fuselage. Slip the wing into the slot in the fuselage and glue in place. Cut out all of

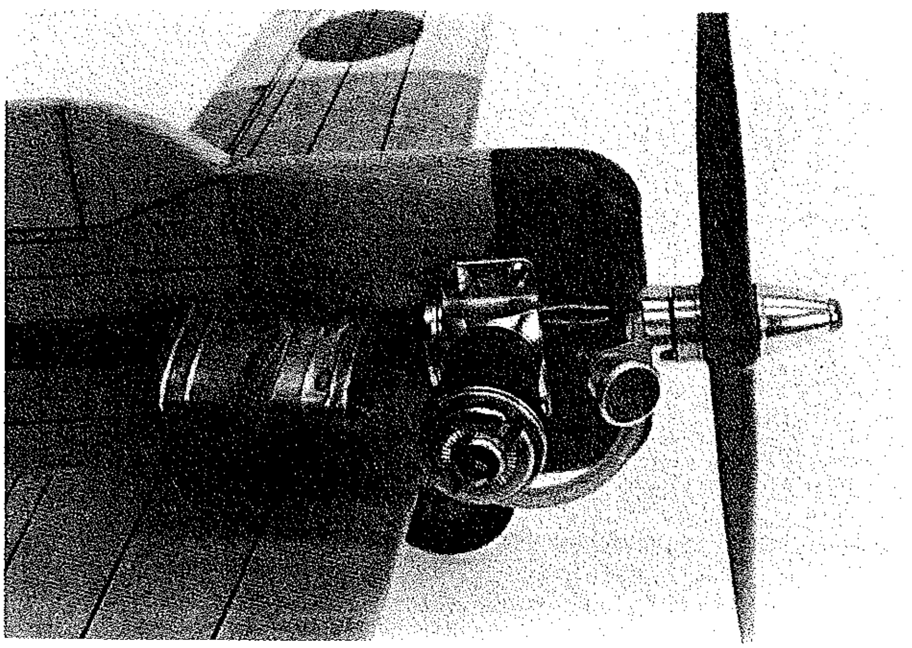


Cox TD .049 and 5-3 prop mounted on the P-26. Use 1/2 or 5/8-in. #3 screws to attach engine to hardwood mounting pieces. Wire fuel tank mount is pushed through the fuselage, then the ends are bent into hooks to take the rubberbands which hold the tank in place. Tank feed must be in line with the engine needle valve for proper running. Also keep the tank close to the engine.

the tail parts from 3/32" balsa and glue the stabilizer into the slot in the fuselage. Glue the fin in place on top of the fuselage. Cut out the 1/16" plywood landing gears, tail-skid, bellcrank mounts, and control horn. Drill a 1/16" hole in the control horn for the pushrod wire, and ⅛" holes in the bell-crank mounts and landing gears. Also, drill two holes in the right side landing gear for the control wires.

Glue the plywood landing gears to the wing and add ¼" triangle on each side of each gear. Mark the bottom of the wing for the center of the bellcrank mounts, and push a pin through the wing on the mark to locate the same spot on the top of the wing. Glue the plywood bellcrank mounts on the tip and bottom of the wing, centering the hole over the mark. Glue the plywood tail-skid in place. Glue the plywood control horn to the bottom of the elevator. The P-26 is now ready for sanding and finishing.

Finishing the models: Shape and round the edges of the models, using #80 or #100 grit garnet, or aluminum oxide, sandpaper. Sand the edges of the elevator and all of the tail parts round, except for the rudder and fin hinge line—which are glued after painting. Finish sand the entire model with #220 garnet, or aluminum oxide, sandpaper in the direction of the wood grain until smooth.



And here is the engine installation on the Nate. Cox TD or Medallion .049 give faster performance than Baby Bee or even Black Widow engines. What was said about the P-26 engine installation also holds true here. The tank is a Perfect #2 Wedgetank. We don't mean to belabor the obvious, but centrifugal forces "pushes" fuel toward the narrow side of tank for good fuel feed.

Brush on one coat of clear dope over the entire model and tail parts, and allow to dry. Sand the entire model with #220 sandpaper until the wood feels smooth again. Brush on a second coat of clear and, when dry, sand smooth. A third coat of clear may be needed in some areas. Additional coats of a sanding sealer, or clear dope mixed with baby powder, can be applied if you want to fill the grain. Sand between coats.

The overall color of the Nate is pale gray, or greenish gray. Use Pactra Aerogloss Military Flats, hot-fuel-proof dope, Cloud Gray as the base color. Regular Aerogloss colors can be used if the Military Flats are not available, although the gray is a little too dark. One part of gray and two parts white would be close enough.

Many Nates were simply painted gray with the round red insignia on the wing and fuselage, but most had additional stripes or designs. The window is masked off with tape and painted light blue. Mask off the white bands and paint with Swift White. The nose and fuselage stripe is red dope, applied after first masking with tape. The best masking tape is Sig striping tape in ¼" width, otherwise use plastic electrician's tape, or Scotch Tape.

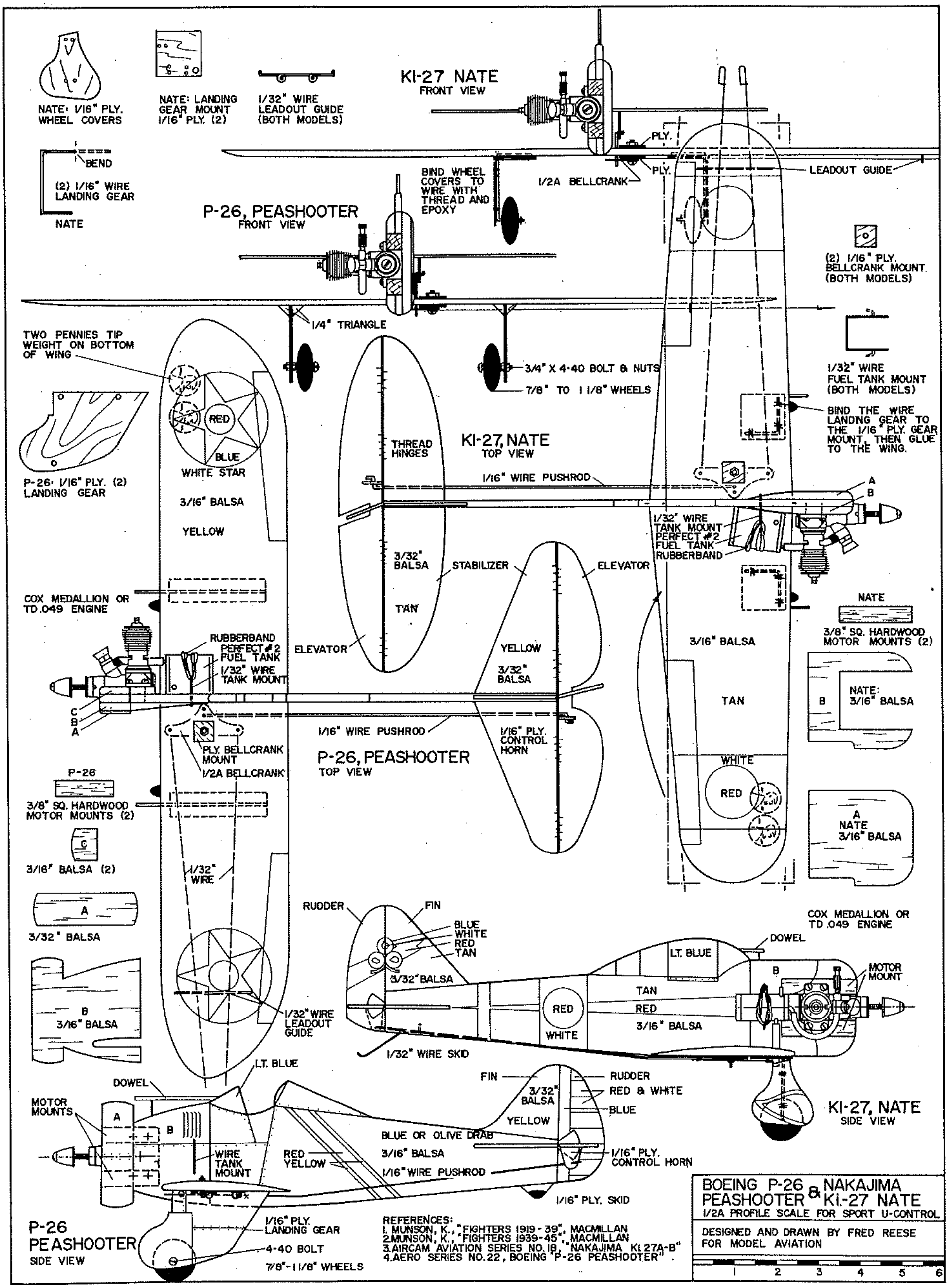
P-26 Peashooters had bright yellow wings and tails, and either dark green or blue fuselages. First, paint the wings, fin, stab, and elevators with Aerogloss Cub Yellow, applying each successive coat in a different direction. Sand lightly with #220 sandpaper between each coat. (Cub Yellow is also available in spray cans as are all of the standard colors.) Allow the yellow to dry for several hours, then mask off at the fuselage junction. If spraying, the wings can each be covered with paper or paper bags and masking tape to protect from overspray. Paint the fuselage either Curtiss Blue or Stinson Green. Paint the separate rudder white.

The insignia and stripes are cut from either Monokote Trim sheets, or contact shelf paper. Contact paper is fuel-proof and inexpensive. It is easy to use and is ideal for masking complex shapes, which can be cut out first. Draw the stars by placing white trim under the plan and marking the star points with a pin through the plan. Connect the points with a pencil and cut out the stars. Stick the stars onto blue trim, draw the circles, and cut out. Apply small red circles in the center of the stars and stick the completed insignia onto the model. The blue stripe on the fin, and the red stripes on the rudder, are cut from trim sheets, then stuck on.

The lines and rivet dots on my models were applied with a #1 rapidograph drafting pen, and Pelikan drafting ink. This ink is water soluble and can be washed off if you make a mistake. Use a ruler with a raised edge to apply the lines. The dots are applied freehand.

I experimented with a black pentel rolling writer and it worked very well, much

Continued on page 89



FULL-SIZE PLANS AVAILABLE .... SEE PAGE 104

Control Line··
Scale··
Mike Gretz

THE FOLLOWING is taken from a letter I just received from Mr. Bill Noonan, of San Diego, CA. "As you may have read or seen on TV, the San Diego Aerospace Museum became a victim of arson on the night of February 22, and sustained a complete loss of its entire collection, considered to be the finest in the U.S. after the Smithsonian's. The fire eliminated such remarkable aircraft examples and displays as a completely re-constructed (not replica) JN-4, Ryan ST, Ryan Fireball, Luscombe Phantom, Consolidated PT-1, Lockheed F-80, Ryan M-1, to name a few original aircraft. The flying replicas included Fokker AE-III, Sopwith Tripe, Spirit of St. Louis, Curtiss A-1, and a number of others.

"One of the most interesting planes they exhibited was a Zero, retrieved from a South Pacific lagoon about six years ago. I think the loss of the research library may be the greatest to scale model builders. The archivist, Bruce Reynolds, was constantly supplying modelers with info for scale stuff. It's tough to think of the complete set of *Janes* as a pile of ashes, to say nothing of *Model Airplane News, Flying Aces, Popular Aviation, Flight,* and a bunch more that dated back to the early 20's. The Director of the museum, Col. Owen Clark, says the new museum will start from scratch.

"The success of the museum will be dependent to a great extent on response to appeals for donations. Col. Clark expressed interest in starting a chronological collection of models, possibly 1″ = 1′ scale, much as the Smithsonian has. The new building has a floor area in excess of 50,000 square feet, and a sizeable portion will be devoted to model display. Any modelers wishing to contribute may correspond with Col. Owen Clark, San Diego Aerospace Museum, Room 203 Casa del Prado, Balboa Park, San Diego, CA 92101."

What a senseless tragedy. The Aerospace Museum's full-size collection included *dozens* of other unique and prominent aircraft which Mr. Noonan didn't list. To me, the museum turned out to be a good source of scale data on the historic Ryan line of airplanes which were built in San Diego. In fact, a couple of years ago my research for data on the Spirit of St. Louis acquainted me with Bruce Reynolds, who impressed me with his eager assistance. He came through with what I needed *months* before any of the other inquiries I had sent out.

One of the Ryan aircraft destroyed, literally the father of the Spirit of St.

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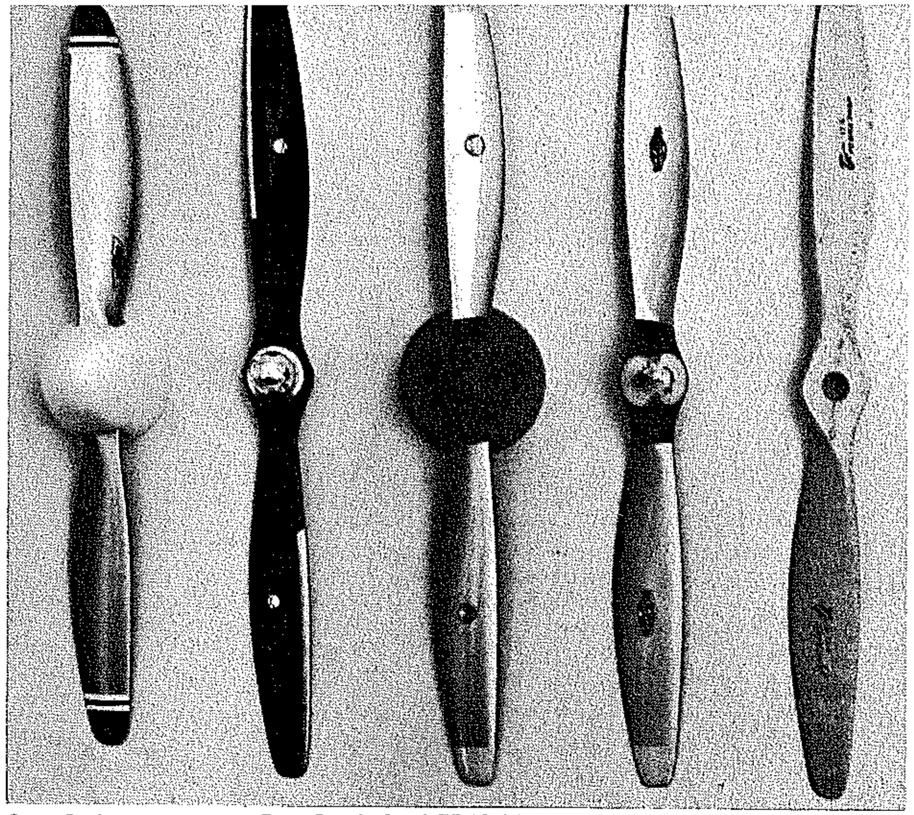
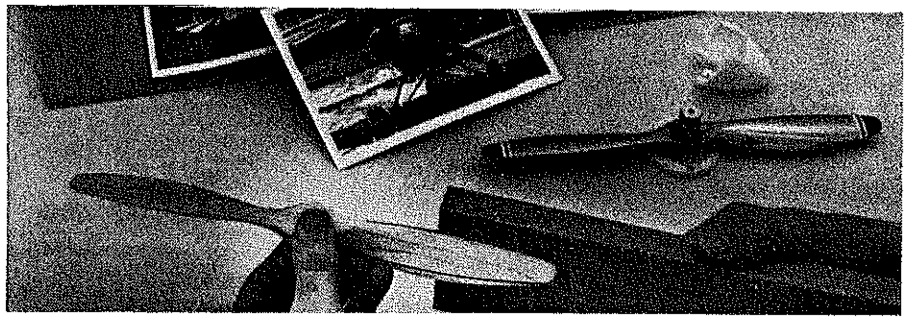
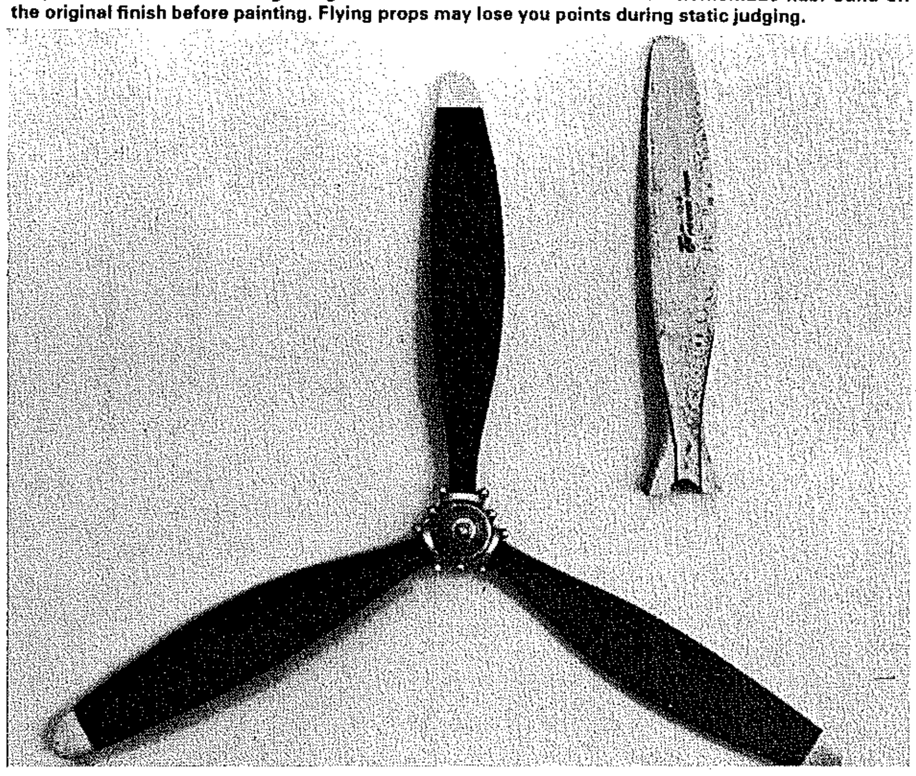


Sport Scale props are easy. From R to L: Stock TF 12-6 Power Prop and display props for Clip Wing Cub, 226 Akrobat, Super Chipmunk, and Smith Miniplane which were all made from it. Note differences in tip, leading and trailing edge shapes, as well as paint schemes.



Scale judging data provides guidelines for sanding the commercial prop blades to shape. Notice inside the spinner cone, that prop nut, prop, and spinner backplate have been epoxied to each other, completing the display unit. The example shown is for the model Smith Miniplane.

Three-bladed Hamilton Standard type props also can be based on the Top Flite 12-6. The Power Prop blades are carved along the guidelines and rounded to fit into the homemade hub. Sand off the original finish before painting. Flying props may lose you points during static judging.



Control Line··
Aerobatics··
Wynn Paul

THE FIVE most asked questions by novice fliers can be perplexing to them and monotonous to advanced fliers. Some of us hear them over and over. Here are some of the answers to the five most often asked questions this writer keeps getting.

"How can I make my profile run smoothly all through the pattern?" Assuming that the engine is mounted securely enough and the nose of the airplane doesn't vibrate too much, that leaves the engine itself and the tank. Some fliers advance the theory that too solid construction can also shake the plane and cause problems. Again, assuming that the engine has been tested on the block and it will run okay there, that all screws are tight, the plug is good, and the spray bar-needle valve assembly is tight and clean, then we have to examine the tank and fuel line setup.

First, let's play with the fuel line since that is easier. Try different sizes of fuel line—bigger, smaller. Make certain that the fuel line doesn't have a pin hole in it. Try a fuel filter if you don't have one in the line already. If you already have one, then try a different size. If you hate fuel filters, then use some larger fuel tube. Try rerouting the fuel line a different way; instead of going under the cylinder try around the other side. Reverse the needle valve assembly. Use some copper wire to keep the fuel tube from getting near the exhaust.

The next thing to try is moving the position of the fuel tank relative to the spray bar. If the engine richens on the top of loops, etc., then try raising the tank about ⅛ in. above the engine center line. If the engine gets too lean, then lower the tank (when viewed from the outboard side at eye level with the engine cylinder pointing straight at you). Make certain that all fuel pickups and vent tubes are soldered tightly and are leak proof. Make certain that the pickup tube extends to within 1/16 in. from the back of the tank and has a 45-degree bevel at the end. If you're running muffler pressure, try constricting the pressure line if the engine is running too rich on the maneuvers. A desperation move is to move the tank into the middle of the fuselage, which requires cutting a rather large hole in the fuselage just behind the engine.

"How do you get that shiny finish?" Preparation of the wood under the paint is one key here; the final application of clear dope is another. The grain must be filled and it doesn't matter whether you use paper, resin, glue, spackling, clear dope,

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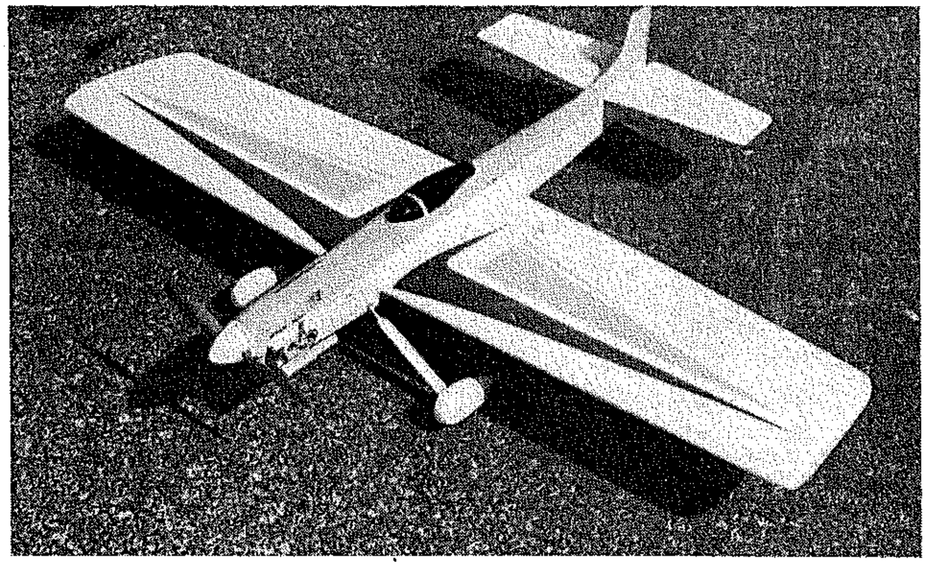
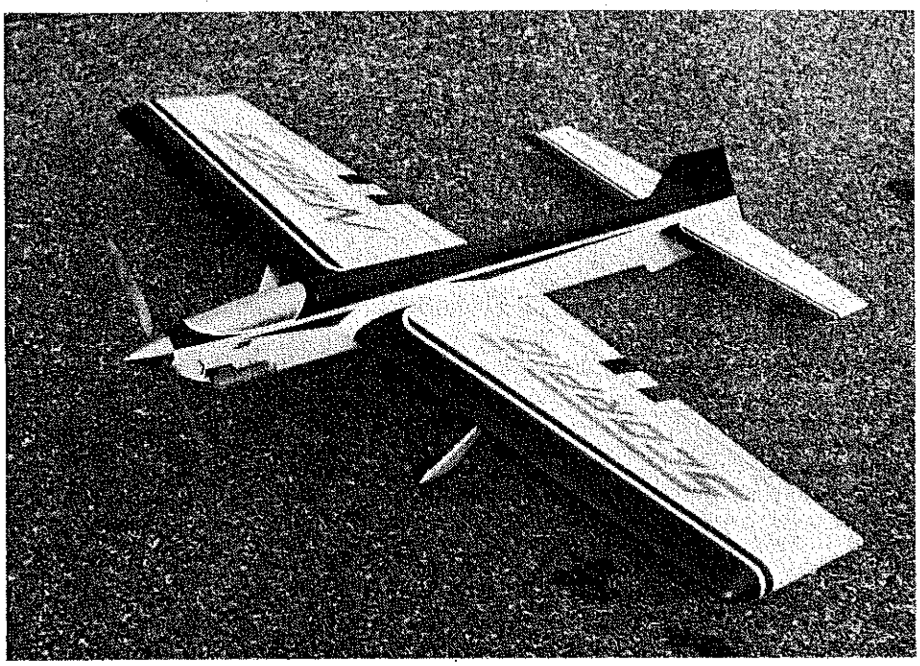
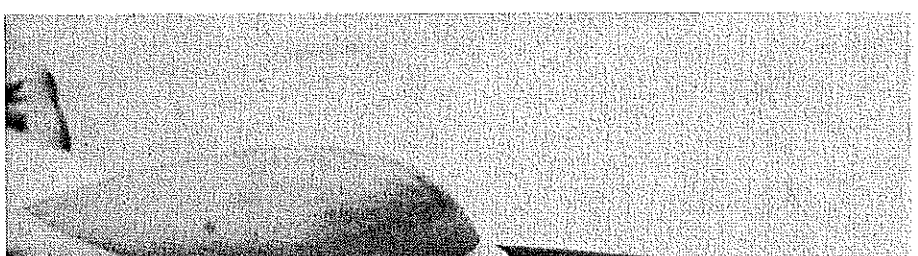


The Celtic IV, created by Elwood Bell, has built-up 55-1/4-in. wing, Max 35 power, own muffler.



Bill Simons Scorpio, has 56-in. C.S.C. foam wing, and is finished in Sig paint. Power is a Supertigre 46. A first class job in spite of only seven working days. All pictures by Wynn Paul.



Unusual cooling vent on airplane built by Jon Ramsden. Nose shape appears distinctive, too.

Control Line Racing

Bill Lee

IT SEEMS that there are many areas in construction and competition that can be best classified as black magic. It seems that every flier has his own way of doing something that is undoubtedly the "best" and the "only" way to do it. Well, I want to talk about a little theory and give some equations about fuel tanks, their shape, placement, and why they act the way they do when in flight. I hope that this will dispel some of the myth that surrounds this topic.

First of all, some basic facts. The weight of water is very near 1 oz. per fluid ounce. This converts to .0346 pounds per cu. in. since one fluid ounce is 1.804 cu. in. O.K., so who's worried about the weight of water? Certainly, we use very little of it in flying model airplanes. Well, as it turns out, fuel is very near water in weight, .96 ounce per fluid ounce. So if we want to understand what goes on with a fuel system, we can investigate using water and know that we are in the ballpark for fuel. Listed below are some densities for various fluids.

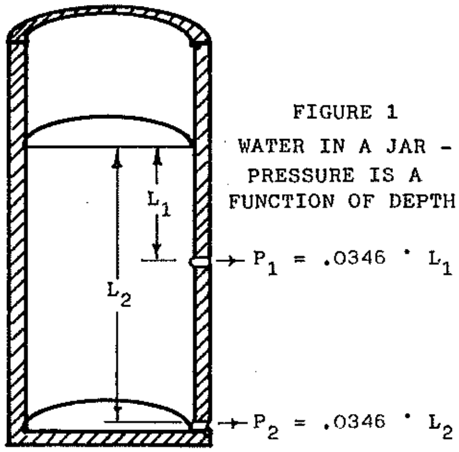


FIGURE 1
WATER IN A JAR - PRESSURE IS A FUNCTION OF DEPTH

	Ounces/ fl. oz.	Lbs./ cu. in.	Specific Gravity
Water	1.0	.0346	1.0
Methanol	.81	.0281	.81
Ucon LB625	.96	.0332	.96
Nitromethane	1.06	.0368	1.06
Fuel (50% nitro)	.96	.0332	.96

As can be seen from the table, alcohol is lighter than water, nitro is heavier, while oil is only slightly lighter. When you combine these components to make fuel, the result is only slightly lighter than water, about the same as the density of oil.

Now how do we apply these numbers? A few principles of physics can help us answer this question. Any quantity of a fluid subjected to force will exhibit some fixed characteristics. The one most important to us is the pressure gradiant within the fluid which is a function of how much fluid is piled above. This pressure can be simply expressed by the formula P = G·L·D. That is, the product of G, L, and D where:

G—The acceleration in affect measured

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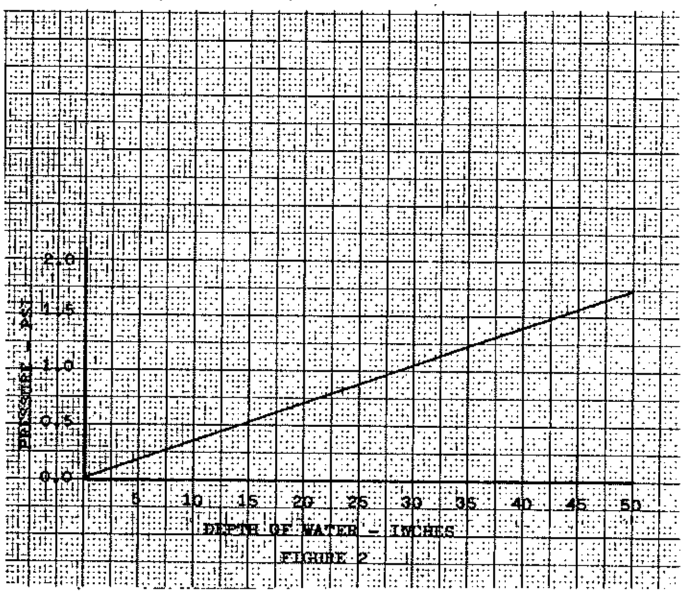


FIGURE 2

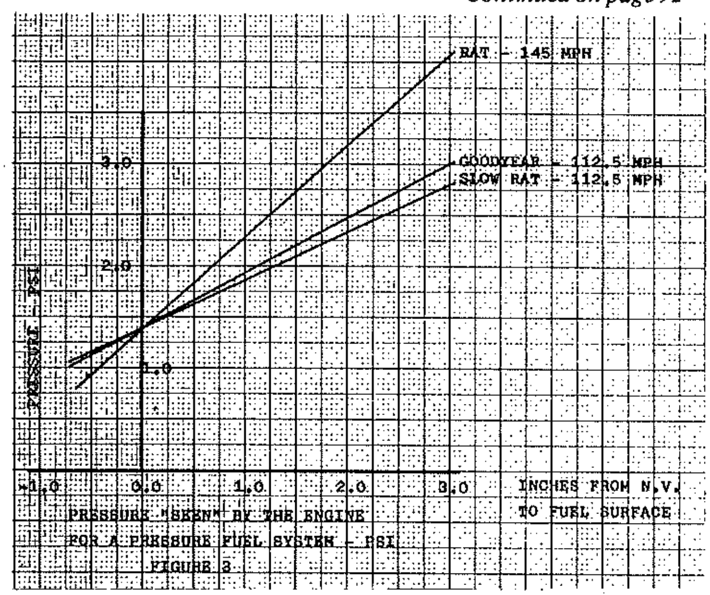
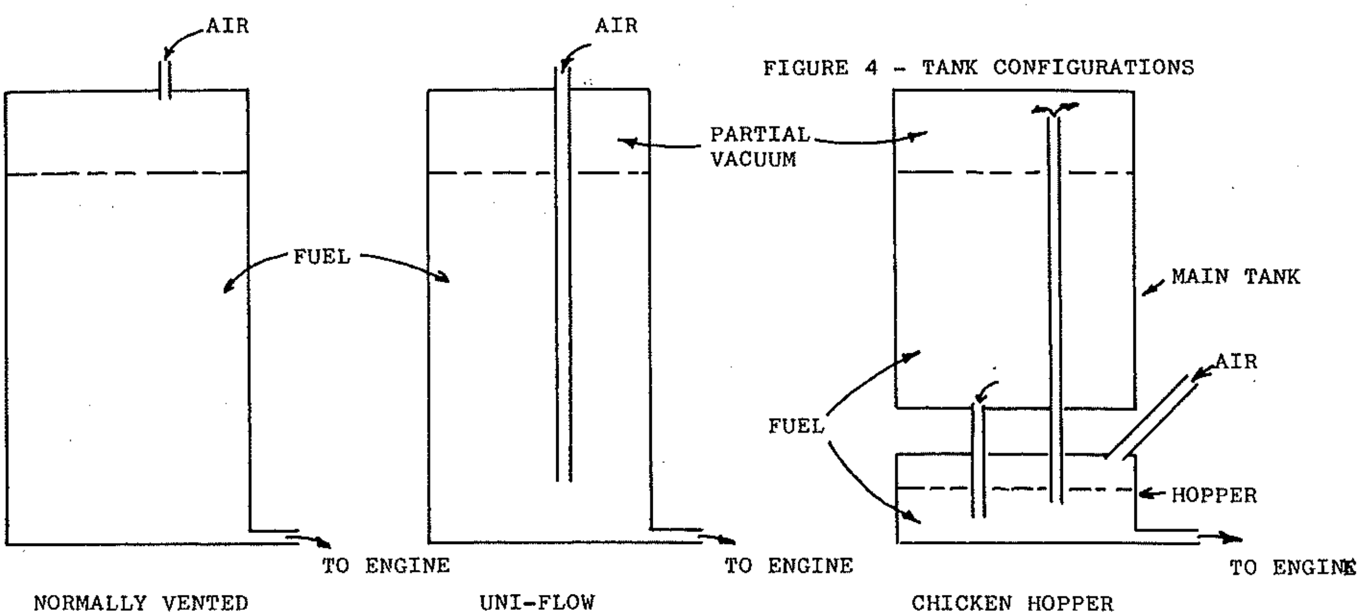


FIGURE 3

FIGURE 4 - TANK CONFIGURATIONS



Control Line··

Combat··

Charlie Johnson

MIKE STRIETER once again compiled the standings for the MACA Top Twenty, this time for 1977. In addition to the Top Twenty I've also included the top ten in each combat classification.

Overall Top Twenty

1. Richard Stubblefield
2. Paul Smith
3. George Cleveland
4. Mike Guthomson
5. Neal Rose
6. Richard Lopez
7. Chuck Rudner
8. Bob Burch
9. Richard Brasher
10. Richard Imhoff
11. Gary Frost
12. Dave Collins
13. Mack Henry
14. Phil Granderson
15. Howard Rush
16. Ed Brzys
17. Andrew Lee
18. Gil Reedy

19) Joseph Ambrose
19) Steve Sacco

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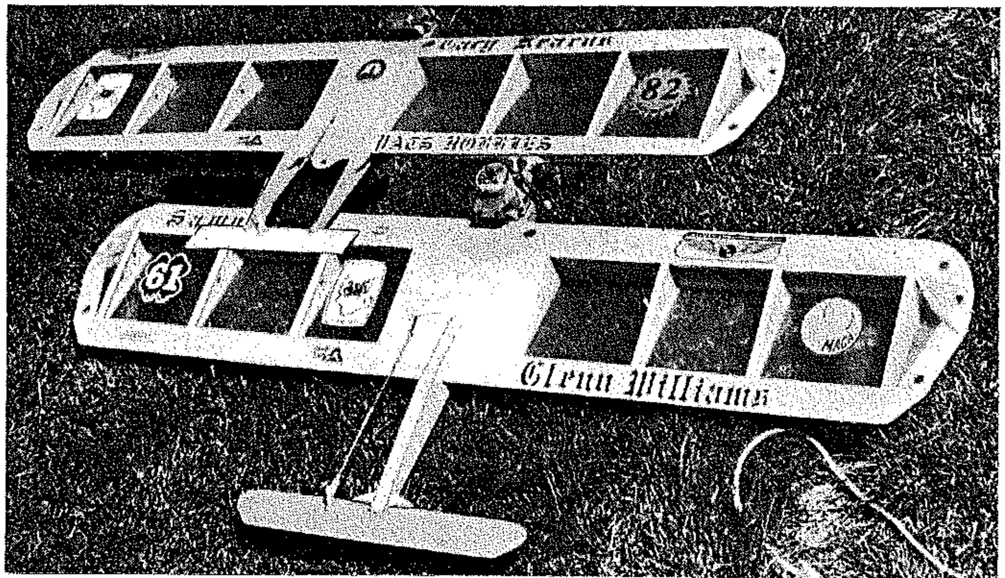
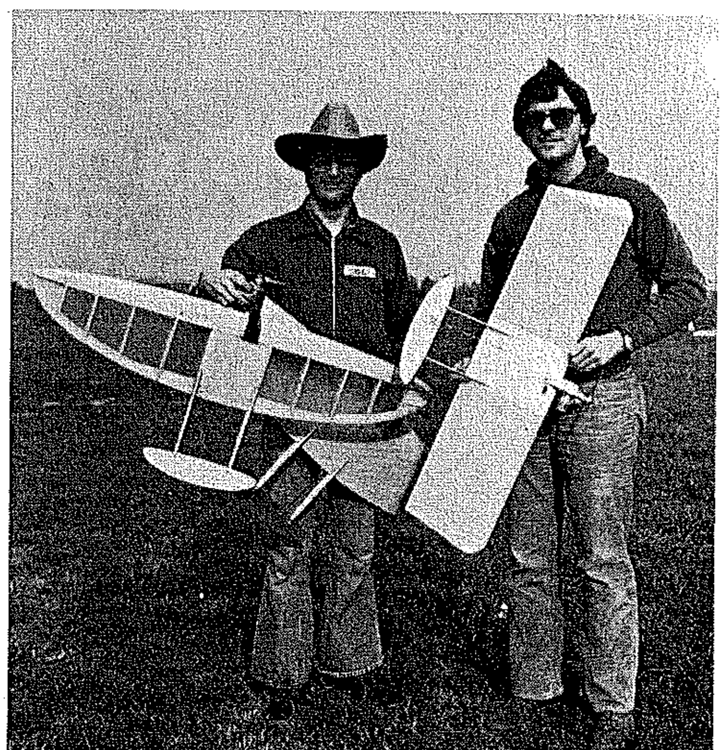


What to do with rear exhaust—novel solution by Gary Kearns and Glenn Williams. Note: WAM required mufflers on both engines; design Lopez's Samurai. Cox .15's, Taipan 7-4 props. Lopez pic.

Closeup of Doss Porter's plane showing engine/exhaust layout. Note safety cable that will be hooked to engine to keep it from coming free of the plane in case of a mid-air or a mount failure. Other end of the safety cable is attached to the bellcrank. Photo by the author.

Doss Porter, left, and Matt Rodriguez at FAI benefit meet held in Los Angeles. Rained out! Doss is 1978 Combat Director, and Matt is the 1977 Junior National Champion. Photograph by Charlie Johnson.



Neal White, left, and Stan Youngblood hold Bosta and Nemesis adapted to FAI. Stan member of Combat Advisory Committee. Johnson pic.

Field at Dayton, Ohio, site of the '76 National Championships. Discussions currently are underway for possible use of this site. No problem at the other end; Kitty Hawk has an airstrip at the Wright Brothers Memorial.

Also being explored is a time period for attempts; perhaps between August 19 (National Aviation Day) and December 17 (anniversary of the Wright brothers flight in 1903).

Obviously, many details need to be developed. In the meantime, lots of dreaming and scheming can be done by would-be record-setters, maybe even model building and test flying. The basic need is to practice cross-country flying, even if only for short distances. Flying from a car (or plane) obviously is a different situation from flying at a contest or the club field.

More on all this will be reported next month. Until then, anyone interested in getting involved is requested to write a note to AMA HQ—we will try to get an information exchange going to keep all interested parties up-to-date on project progress. In the meantime, you might refer to the August 1975 issue of Model Aviation regarding transcontinental flying, or any more recent issues describing record breaking distance or duration flights. Note: The October '76 issue tells how Richard Weber flew for 10 hours and 48 minutes while setting a new closed course distance record of 424 miles.

Fighters Two/Reese

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easier to use than a drafting pen. All lines and ink marks must be sealed with one or more spray coats of clear after the model is finished. Apply the first coat very lightly from a spray can to prevent the ink from bleeding. The Pentel pen bled much less than a Flair pen.

Assembly: Hinge the elevators to the stab with a large needle and carpet thread, using a "figure-8" stitch. Leave about 6" of thread at each end of each hinge until all are done, then using the needle as a pick, pull the threads until the hinge is tight. When all the thread hinges are tight, apply glue to both sides of the hinges and clip the loose ends flush with the wood.

Bend the 1/16" wire pushrod and attach to the control horn on the elevator. Cut the 1/32" wire leadout wires and attach to the bellcrank along with the pushrod. Bolt the bellcrank to the wing, keeping the entire linkage free from binding. Bend the wire leadout guide and glue to the wing.

Predrill the four mounting holes with a 1/16" drill, then mount the engine with four #2 ½" wood screws. Drill two 1/16" holes through the fuselage for the tank mount wire. Slip the wire tank mount through the holes and bend the ends over to form hooks. Place the tank in place and secure with a rubberband. Drill a 5/32" hole up through the wing, directly under the fuel tank vent tube, then push a 1" length of fuel tubing up through the hole and over the vent tube. Glue two pennies to the underside of the outboard wing tip to help maintain line tension while flying. Enlarge the cutout in the rudder to clear the elevator if needed, then glue the rudder to the fin at the angle shown on the plan. Put on the wheels and you are ready to fly.

Flying: Use 26' × .008" wire lines for flying if possible, rather than the Dacron flying lines, for more positive control. Use a Cox 5 × 3 gray plastic prop, or a Cox 5 × 4 black plastic prop, and Cox Glow Fuel. The higher nitro content of Cox Racing Fuel will take off the paint.

CL Scale/Gretz

continued from page 34

Louis, was the sole remaining example of a Ryan M-1—now lost forever. The best way that most will be able to help is to spread the word that the new museum is looking for donations of full-size aircraft, models, and aviation artifacts to begin their new collection.

The Current Sport Scale Rules (sect. 6.5a) allow a contestant to substitute a scale-like propeller for his regular flying prop during static judging. This recognizes that, even though the propeller is not visible in flight, it is just as significant a part of an aircraft's identity as the tail, landing gear, canopy, etc. A 2-bladed 11" dia. flying prop on a P-51 (scale is 4 blades), or on a model Corsair and GeeBee racer with a 9" dia. radial cowl, looks ridiculously inappropriate and can thus diminish the appeal of such subjects. In fact, if you weren't allowed to use a more scale-size and color-display prop, airplanes such as these would be at a distinct disadvantage during static judging.

The follow-up section (6.5b) of the rules requires that the flying spinner be the same size, shape, and color as the spinner presented for static judging. It's based on the premise that to allow a change to a completely different style of spinner—to facilitate using a starter, or for whatever reason—would also be unfair to certain subject choices. Normally, the color and outlines of the spinner are still clearly visible even when it is revolving. Nobody would like to see a J-3 Cub flying around with a 2" spinner hanging on the nose. If your full scale subject didn't use any type of spinner cone—just a prop hub, crankshaft, and a lot of bolts—the rules do require that you use some sort of a rounded "acorn" prop nut for safety. These interrelated rules provide for all different aircraft subjects to be viewed to equal advantage during static and flight judging, which is a problem and goal inherent in all scale events. How much of a burden is it to produce an adequate scale prop to make your Sport Scale model competitive under the current rules?

In almost all cases, the diameter of the flying prop will figure out to be several inches smaller than the diameter needed for an accurate scale prop. In Precision Scale it is usually necessary to meticulously carve a scaled-down replica out of balsa wood. That sort of time-consuming effort isn't called for in Sport Scale. From 10 feet away only the number of blades, the relative size of the blades, and the general colors are noticeable. I've found that most of the time a good Sport Scale prop can be made by modifying a stock commercial wood prop!

The accompanying photos show some of the possibilities using a Top Flite 12-6 Power Prop. The first step is to decide what size commercial prop best fits your needs. Carefully study the photos and/or drawings you will use in your presentation—this is what the judges will be going by. I've found that props with a pitch of more than 6" will usually appear too thick when painted, but it will depend primarily on the scale of your particular model. Most commercial wood props within a few sizes of each other have essentially the same width and length hub area. If you don't know the actual scale length needed, look for a prop of sufficient diameter to look right, primarily in relation to the cowling and ground line.

Sand *all* of the finish off the prop with medium grit sandpaper. Now, by modifying the tip shape and adjusting the planform of the blade's leading and trailing edges with a sanding block, the character of many full size propellers can be captured. It's best to draw guidelines on the blades and sand down to them. That makes it easier to get both blades the same. Don't worry about balancing, since this prop will never be used for flying or even running the engine. When satisfied with the shape that you've created, taper and re-round the leading and trailing edges with the sanding block. Then sand the entire prop smooth again with medium grit paper. Brush on 4-6 coats of unthinned clear dope, sanding between coats with fine sandpaper. When you have built up a smooth, clear dope base and haven't sanded through to the wood anywhere, you can start painting on the colors.

It's best to spray the color and final coats of dope, especially colors like silver, but a satisfactory job can be done with a brush if you remember three basic rules. (1) Thin the color dope adequately to allow it to flow on smoothly. (2) Always brush from a dry area into a wet area. (3) Keep brush strokes to a minimum. After the colors are dry, spray several coats of clear dope overall. All of the props shown in the photos are painted flat black on the back of the blades, as is scale in each case.

For mounting the display prop, I prefer to epoxy an extra prop nut permanently to the prop hub. If yours include a spinner, you can hide the prop nut inside of it. If yours has a spinner nut, as the Clip Wing Cub and Super Chipmunk props show, epoxy the nut right onto the front of the hub. Thus, when the ratty, scarred flight prop, spinner, and/or nut are removed, the immaculate display prop assembly is simply spun onto the engine shaft to do its job.

PLEASE DON'T FLY NEAR ELECTRIC POWER LINES!

Mike Gretz, Box 162, Montezuma, IA 50171.

CL Aerobatics/Paul

continued from page 35

talcum powder or epoxy-type paints. Well, it does matter from a weight standpoint; spackling and auto primer fillers can be heavy if used too freely. Silkspan or Japanese tissue over the wood is the old standby followed by several coats of filler coat (commercial filler or talcum powder mixed with clear). Be certain to apply several coats of clear dope over the last filler coat so that the paint can have a good base to adhere to for durability.

Resin and glue undercoats have come into prominence the last 4-5 years although there was an article on this method in *American Modeler* in October, 1959! These finishes have proven fairly light when care is taken to sand throughly between applications. The resin and glue applications should be scraped off the surfaces with a playing card, or piece of 3 × 5 index card, and the rest wiped off with paper towels. Sanding between two applications should be with 300 or 400 paper. Then a couple coats of clear are applied over the resin or glue for a good base for the paint.

Spackling or auto primer fillers can be used, but care must be taken to sand thoroughly to prevent excess build up and subsequent weight build up. A fellow flier weighed a 35-size plane before and after sanding on auto body primer. He had removed three full ounces of weight in sanding alone!

The epoxy-type paints can be used right from the bare wood up and can end up with some very good looking results. Epoxy paints will usually go over other types of dope (but don't bet on it without first trying on a sample). Dope will not adhere over epoxy-type paints. According to Glenn Fultz, Cincinnati, you can spray epoxy type clear finish over most any kind of dope finish for both "shiny finish" and fuel protection.

Ed Allen, one of the Southern California 500 stunt club members, likes to use acrylic lacquer and acrylic enamel paints for stunt ships. Such brand names as Dupont acrylic lacquer, Dizler, R.M., and Nasson can be used. He says that you must finish up with an acrylic clear enamel over the paint which will then be fuel proof. Great care must be exercised with these acrylic paints: well ventilated spray area is mandatory and a paint mask must be used, or serious permanent injury can be experienced. These type paints should not be used by the beginner. Get some one to help you who is experienced in the use of acrylic paints.

After the paint is on, trim is applied, ink lines are on, then it's time for clear dope applications. A couple of light mist coats are needed to seal the ink lines, any decals, letrasets and edges of the canopy. Then, lay on the coats of clear. Some very careful sanding with wet 600 between the last couple of coats of clear will help to achieve a beautiful finish. And, rubbing compound is a must on dope and acrylic finishes.

"Why is my plane so heavy?" The first culprit is the wood selection. Of course, we all cannot sift through and find the 4- and 5-pound balsa. However, you can cheat some, and then it is possible to build light with just mediocre wood. Instead of using 3/32 in. wood substitute 1/16 in. Instead of using a hollowed block, use a molded balsa top and bottom block. See Al Meyers' Mustang article in the March, 1978, *Model Aviation*. Instead of using a one inch block for the top, make the fuselage sides ½ in. higher and then use a ½ in. block hollowed out. When hollowing the blocks you easily should be able to see the light of a 60-watt bulb through the wood.

Regarding the woodwork, don't go in for big overhangs from the elevator to the rear of the plane. Eliminate anything that sticks out behind the elevators. Make tiny fillets. If you find yourself with a fillet that fits your index finger, then go back and sand it down to fit your little finger. After you are finished hollowing out everything: blocks, tips, cowling, nose, inside the leading edge, etc., then go back and do some more. Al Rabe once said that if you don't go through the surface at least a couple of times on blocks then you're not making them thin enough.

However much glue you have been using, cut the amount in half! Impossible, you say. Not really. You must force yourself to use the minimum amount of glue or fiberglass and then convince yourself that it will hold. Remember, if you are really trying to build a competitive airplane then it needs only to hold together in the air. If it does hit the ground then it should be a total wreck. In the words of Californian Bill Fitzgerald, "If it stays together when it hits the ground, then it's built too heavy!"

Sand off as much as possible on the undercoats before painting. So you go down to bare wood. Then patch it up. Sand, sand, sand. When ready to paint, make the first coat silver—it will cover the wood easily and will show up *all* flaws. After the first time you use a silver undercoat, you probably will never go without it again. Sand after every coat of paint. Be sparing with the spray gun. Sand after the first three coats of clear. And, finally, sand and rub out the plane as much as possible—you can cut up to two ounces here.

"How do I get a consistent engine run?" Get back to the basics of engine, plug, fuel, muffler and tank. If the engine will run on the block, or in another airplane, and you've checked for loose head screws, loose backplate screws, clogged spray bar, broken needle (especially in Maxes), then you have to go to other components. Don't be hesitant to change glow plugs because they now cost a dollar or so.

Is your fuel consistent? If it's a home brew there is a good chance that it could have picked up some water from the air. There's also a chance that the home brew is not consistent with the last batch. I had a horrible experience that cost me two engines and a place or two in the Nationals with some backyard brew that had *no* oil. Sure, there are lots of smaller fuel distributors who have good, consistent mixes of fuel, but you need to be careful. And, I will maintain that two gallon cans of the same fuel side by side can run differently.

It seems unlikely that a muffler could cause an inconsistent run, except if the muffler pressure is too much or too little. Experimenting with the size of the muffler pressure lines could help. In some instances the muffler pressure fitting is in a bad place receiving too much or too little pressure. Finally, the back pressure of the muffler may be causing the engine to heat up and/or not allowing the engine to breathe properly for a good run.

I feel that most inconsistent runs stem from the fuel tank and fuel lines. The tank must be checked for leaks, broken tubing, clogged lines. The fuel tubing must go in as straight a line as possible from the pick-up tube to the spray bar. No bends or twists that are not necessary. If you have a removable tank, this makes it much easier to adjust. The tank can be moved up and down in relation to the spray bar. Or, the engine can be adjusted with shims, etc. I recall that Bill Werwage inletted the mounting beams on his 1977 Juno so that he could raise the engine (when the airplane is viewed in the upright position).

"Where did you get that design?" I doubt seriously if more than 25% of the stunt fliers could plot an airfoil mathematically and accurately from scratch. And, I doubt if many more have had aeronautical design training other than from what they picked up in the model magazines. We all like to sit down and sketch out a new plane, then put it into working drawings using proven wing areas, force moment arms, tailplane sizes, and powerplant components. Actually, how many canards have you seen at the Nationals in the finals of Open Stunt? How many disguised combat planes have won the Walker Cup trophy? And, I've only seen one person ever fly the Sea Fury. Yes, I know that a twin-engine stunter placed back in the '60's. (1967, Rich Loomis, first in Senior.)

The best advice I can give to someone who wants to depart from a kit airplane is to look at what works for other accomplished fliers who do well in competition over a period of years. Then sit down and draw up a couple of planes that appeal to you. Then, using some full-size plans from published planes that have been in Nationals and FAI competition, adapt your rough drawings to utilize the basic important ingredients that must be present for a successful stunt plane: wing area related to engine size and total weight, aspect ratio of the wing, force moment-arms for both nose and tail, tailplane size (tail volume), flap size, thrust line placement in respect to the wing, fuselage side area, control movement, equal or unequal wing panels, leading edge sweepback, dihedral, airfoil size, and tip configuration. Lastly, stick with your design for three or four versions to work out the bugs.

For information on stunt or PAMPA, contact Wynn Paul, 1640 Maywick Drive, Lex., Ky., 40504.

CL Racing/Lee

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in units of acceleration due to gravity.

L—Distance measured in inches from the free surface of the fluid to the point where the pressure is being measured, measured in the direction of the force which is causing the acceleration.

D—The density of the fluid measured in pounds per cubic inch.

What this formula tells us is, that as you pile up more and more fluid on top, the pressure we feel is correspondingly higher. In a model airplane these three variables are: G-loading due to centrifugal force as the plane flies in a circle: the density is that of fuel carried in the tank; and the distance, L, is the distance from the free surface of the fuel to the hole in the needle valve measured perpendicular to the line of flight. Fig. 1 illustrates this pressure as if we had a jar of water and we were measuring the pressure in the water at various levels in the jar. Note that the pressure exhibited is independent of the shape of the container, only on the three variables, G, L, and D.

A couple of intersting numbers can be calculated from this formula. First of all, what kind of pressure change would we see as the variable L is reduced from some value to some other value? Fig. 2 is a graph that shows the pressure change for water under the normal force of gravity as a function of the depth of the water; that is, how much water is above the point in the water where the pressure is being measured. As can be seen, the pressure changes by about .0346 psi/in. of water or about ⅓ psi in 10 inches. In order to verify this number, I built a simple test apparatus that consisted of 104" of large diameter plastic tubing with a pressure gauge attachment that enabled me to read pressures at various places in the column. Much to my relief, the theoretical values were supported in reality as I measured 3.6 psi at the bottom of the column. 104 inches of water under 1-G acceleration results in 3.6 psi.

O.K., so much for water in a jar, how about fuel in a fuel tank? First off, you have to measure the G force on the model and, hence, on the tank and fuel in it. The G loading can be calculated if you know the line length and the speed which the plane is flying.

A few representative values of G are listed below.

$$G = \frac{(1.467 \times MPH)^2}{32.2 \times \text{line length}}$$

A few representative values of G are listed below.

MPH	*G's at 52.5'*	*G's at 60'*
100	12.73	11.14
105	14.04	12.28
110	15.40	13.49
115	16.84	14.73
120	18.33	16.04
125	19.89	17.40
130	21.51	18.82
135	23.20	20.30
140	24.95	21.83
145	26.76	22.42
150	28.64	25.06

A 16.0-flat Goodyear will be pulling at 16.11 G's, while a Slow Rat at 16.0 flat is pulling at 14.09 G's. Now, if you crank these G-values into the first equation, along with the density of fuel at .0332 lbs/cu. in., you find that the pressure variation for our 112.5-mph Goodyear is over ½ psi per in., and only slightly less than ½ psi per in. for the Slow Rat. That is, if the tank is one-inch wide, the pressure variation as the fuel level changes from full to empty, will be in the neighborhood of ½ psi. And this pressure variation will occur regardless of whether or not you are using a pressure fuel system. Of course, in Slow Rat, only suction systems are allowed, but that ½ psi variation will be there for the pressure system on the Goodyear, too. And it's pretty obvious that a wider tank will result in a greater variation. The general rule, then, is to keep the fuel tank as narrow as possible. Tall and long, O.K., but narrow as possible to keep the pressure change to a minimum.

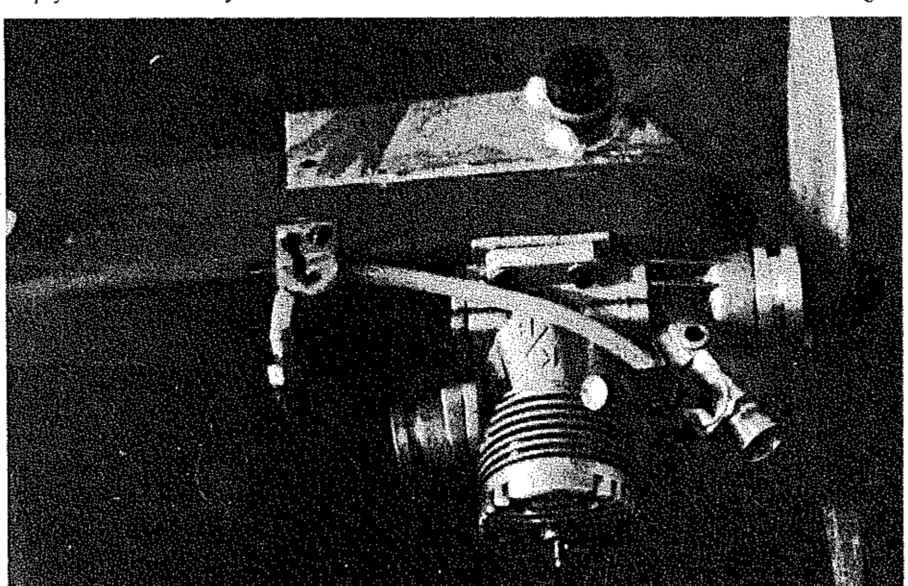
A good question to ask here is, "How much does this pressure change affect the total pressure in a pressure system?" In order to find an answer to this, you have to know the pressure that is created in the tank by using crankcase pressure. I set up a test stand to measure this and found that the tank pressure from an untimed crankcase tap is about 1.4 psi, or about 1.6 psi if a ball-check is used in the pressure line.

In order to find the pressure that your engine "sees" when you are in the air, you have to add the pressure due to centrifugal force, that can be calculated above, to the pressure placed in the tank by the pressure line. Fig. 3 illustrates the pressure at the needle valve as a function of the distance from the needle valve to the free surface of the fuel. The basic assumption here is that crankcase pressure results in 1.4 psi. Given that ½ psi variation per in., the pressure change as the fuel level changes is significant even in a pressure fuel system.

There are three basic, non-pressure tank set-ups in general use today: the normally vented tank, the uni-flow tank, and the chicken-hopper. Each of these tank designs has different but very predictable pressure characteristics that a modeler has to either use or allow for in his design. Fig. 4 shows the three types of tanks as if they were gravity feed. This is intended to help you visualize the effect of centrifugal force by thinking of the effect of gravity. Note that the normally vented tank will cause the pressure to vary continuously as the level of the fuel in the tank changes from full to empty. This obviously is the reason this kind of tank causes the rich-to-lean needle setting that we all have encountered.

In the case of the uni-flow tank, the placement of the air bleed line is all important. The pressure "seen" by the engine will be equal to the pressure, as if the free surface of the fuel was *always* at the level of the air bleed *as long as the actual free surface is above the bleed.* When the air bleed is above the free surface of the fuel, the pressure will change continuously, since the tank has become a normally vented tank with the bleed out of the fuel. One aspect of the uni-flow tank that will cause problems is the need for the tank to be airtight after the fuel has been put in, so that the air bleed can work properly. If the tank is not sealed, it will act just like a normally vented tank since that is precisely what it has become.

The chicken-hopper tank uses a "demand and feed" principle. The tank is really two tanks, one that is sealed and large, the other that is a normally vented tank and is small. The engine draws fuel from the small tank, drawing the fuel level down until the vent to the large tank is uncovered. This allows a bubble of air to get into the large tank and a corresponding quantity of fuel to flow back into the small hopper tank. This process repeats as the engine uses the fuel out of the small tank. The chicken hopper has several notable characteristics. First, since the hopper tank is usually small, the pressure variation it develops as fuel is used is normally quite small, a desirable attribute. Second, this tank set-up usually exhibits a tendency to run rich for a short while until the pressure in the main tank decreases to the point that the vent from the hopper tank starts to work. Third, the main tank *must* be airtight. The chicken hopper tank usually results in a large amount of "plumbing" to install.



This installation of K&B and tank in Bill's Slow Rat follows the findings of his test program.

There is one thing in common to all three of these fuel tank set-ups: they require the fuel to be drawn to the engine by the venturi action of the engine itself. This is the fact that causes you to use pressure fuel feed systems in those events where they are allowed. But in events like Slow Rat or Slow Combat, pressure systems are not allowed. And it's here that a properly built and installed fuel tank will make or break an entry. Here in Texas, the dominant fuel tank set-up is somewhat different from any I've described above. Look at the picture that accompanies this column as you read this description.

To my knowledge this design was first used by Larry Miller and Larry Hoffman from Corpus Christi, Texas, about two years ago. The general idea is to mount the fuel tank on the inboard side of the nose of the plane. This causes, as we have seen above, a significant amount of pressure to be "seen" by the engine due to the centrifugal force and the tank placement. In fact, on my plane which is in the pictures, the fuel free surface varies from three inches to two inches as the engine draws fuel from the tank. This translates into a pressure (at 16.0 flat) of 1.4 psi, when the tank is full, to .94 psi when it is absolutely empty.

Now, my tank is just about half empty after 35 laps, and this means that the pressure my engine "sees" is about 1.2 to 1.4

psi. This is very nearly what a pressure system would yield if using untimed crankcase pressure. The real key to the system's operation is to use a carburetor that has a very large hole for air and is arranged to be closed on the ground when there is no pressure in the tank due to centrifugal force, but open in the air to take advantage of the tank pressure due to centrifugal force.

We have been using the old Pylon carb that K/B once supplied for the old Series 71 rear-rotor 40. We put a big blob of solder on the throttle arm so that, not only does the centrifugal force supply the pressure to the fuel, but it causes the carburetor to open to take advantage of the pressure. The carb has to be used, we've found, in order to get the airplane into the air, and until the centrifugal force builds up. We've also found that you must set the needle valve in the air, since there is no reliable way to set the needle on the ground and have it right in the air. This tank set-up, while it looks rather wierd, does work very well and results in the ability to use a venturi as large as is used in any pressure system with the corresponding increase in engine performance.

Bill Lee, 2522 Tamarish Lane, Missouri City, TX 77459.

Safe Flying Is No Accident!

CL Combat/Johnson

continued from page 37

Fast Combat Top Ten

1. Richard Lopez
2. Richard Brasher
3. Richard Stubblefield
4. Bob Burch
5. Chuck Rudner
6. Mike Guthomson
7. Neal Rose
8. George Cleveland
9. Phil Granderson
10. Paul Smith

Slow Combat Top Ten

1. Paul Smith
2. Richard Subblefield
3. Mike Guthomson
4. George Cleveland
5. Andrew Lee
6. Paul Curtis
7. Gil Reedy
8. Chuck Rudner
9. Ed Brzys
10. Joseph Ambrose

FAI Combat Top Ten

1. Neal Rose
2. Richard Imhoff
3. Paul Smith
4. Max Mearns
5. Howard Rush
6. Richard Stubblefield
7. Gary Frost
8. Bob Burch

9) Phil Cartier
9) Chuck Rudner

Last year, I received a few queries as to why certain well known and very competent combat fliers were not on the list. Probably, the most common reason is that the person is not a MACA member. The question then arises, that if this list is for MACA members only, then why not count only wins against other MACA members and not all combat fliers in general. Others have complained that, even though they are MACA members, they are limited to the number of contests they can enter (and get points) because of weather or no contests. California, Florida and Hawaii should have a death grip on the Top Twenty if this were the case, which they do not. One other factor for many of the Southern California fliers is that many of the combat meets are restricted-entry contests, and are not counted toward the standings. I would think your objective throughout the year would be to have fun at contests and do your best and not devising ways to get more points.

I usually make a pitch for MACA at the end of most articles but I think I'll catch you off guard this time. You owe it to yourself to become more knowledgeable about Combat even if you don't fly in competition. To join MACA, send $6.00 ($10.00 overseas) for a one year membership, along with your name and address to MACA Treasurer, Patty Sasnett, 1443 McKinley Ave. Escondido, CA 92027. Please state if it is a renewal and list the MACA member responsible for your joining.

It is not my intention to duplicate the contest calendar found in *Model Aviation* but I would like to call your attention to several contests that deserve our support. The first of these is the United States Control Line Model Airplane Championships, held June 17 and 18 in Winston-Salem, North Carolina. Bill Pardue has added FAI Combat this year on condition that combat fliers step forward and help run the event. Remember, this is the only control-line AAAA contest in 1978, and the biggest except for the Nationals. The MACA Combat Championships will be held on the 8th and 9th of July in Cincinnati. Fast, Slow, ½A and FAI Combat will be featured. There will be a Top Twenty challenge where you may challenge any Top Twenty person for a $5.00 fee which will go into the MACA treasury. Speed and Performance will be featured both days and will consist of the following: 1) Time from takeoff, 2) fly four level laps, 3) 3½ inside loops, 4) Pull out inverted and fly four inverted laps, 5) 3½ outside loops to level flight, stop timer, 6) Seven level laps at 15 feet or less for top speed.

Score will be the total number of seconds for the maneuvers, plus the num-