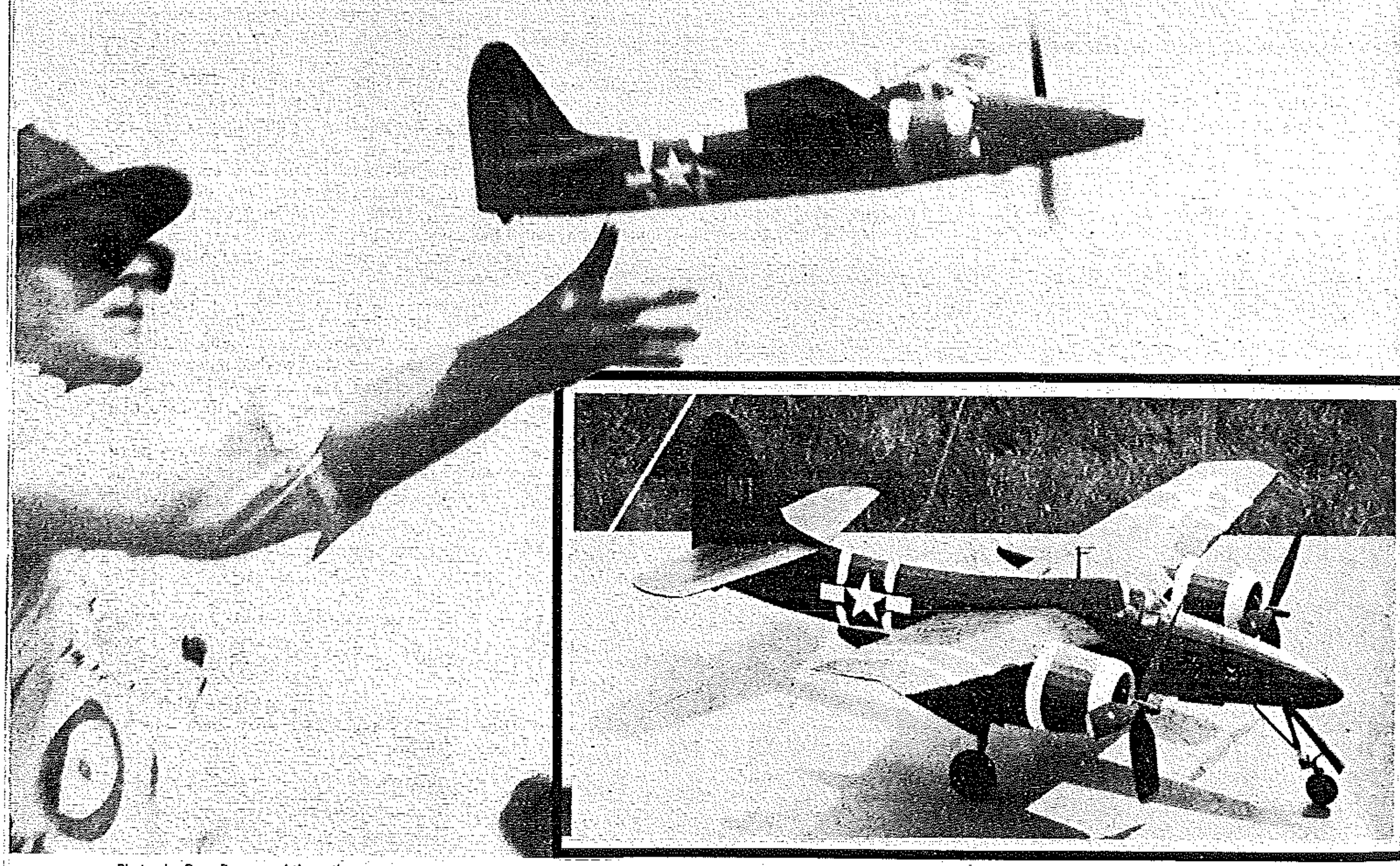
Dennis Norman

Tigercat

Who said twin-engined rubber jobs are impossible—or even limited? This one is a winner and has done 43 seconds—so far. . .



Photos by Russ Brown and the author

While it is possible to launch a twin-engined model by holding each prop and then tossing the ship with two hands simultaneously, Dennis prefers a cradle (see text) which retains the props, the cradle being held in one hand and the ship in the other. Cradle is pulled free, then the ship launched in the conventional manner. Insert: Detachable gear is for static purposes.

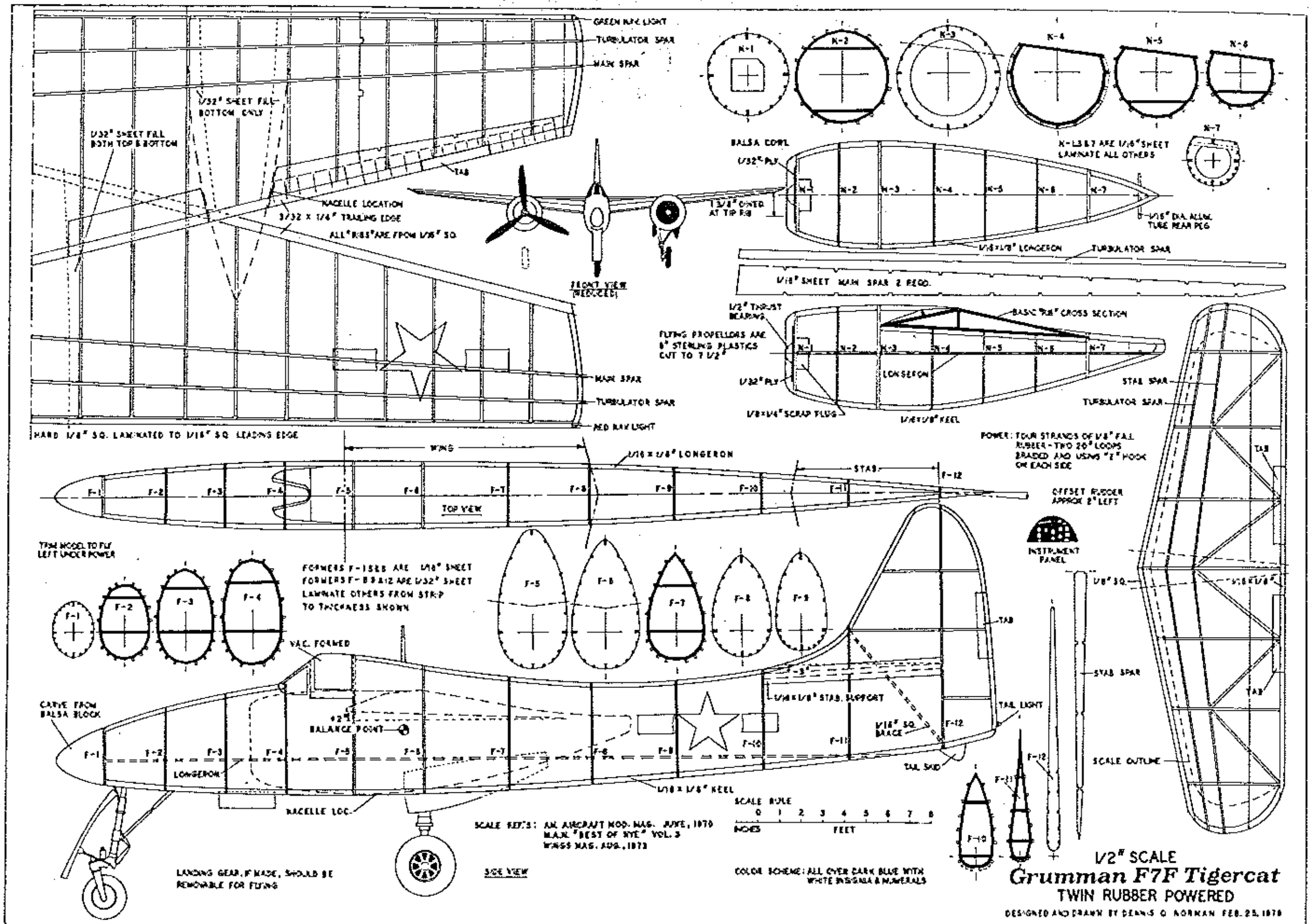
ALTHOUGH too late to see WW II combat, the Tigercat has been called "the hottest, most powerful twin-engine fighter of its day." Its angular wing and full-bodied nacelles with their radial engines clearly show the corpulence usually associated with other "cats" of Grumman's WW II family. The surprise in the Tigercat's design is its extremely narrow and very graceful fuselage, virtually built around the pilot's dimensions, giving it a slim, almost sailplane-like look. The nacelles are proportionally longer and more widely spaced than those of most twin-engine subjects. This, of course, is of particular significance in selecting it as a rubber-power scale subject, since nacelle length and propeller size are both important items of consideration.

Construction: The first consideration in designing the Tigercat was that it be as lightly constructed as possible without sacrificing strength and scale appearance. The selection of light-weight wood is of major importance. All the wood used in the construction of the prototype model was purchased from Micro-X-Products, P. O. Box 1063, Lorain, OH 44055. (There are numerous other sources of fine quality materials.) If you cannot select the wood yourself, be sure to instruct the person making the selection to use care in selecting straight grain, but light wood.

Much of the Tigercat is built from strip stock of relatively short length. If you do not already have one, I recommend that you make, or purchase, a balsa stripper. An excellent balsa stripper may be purchased for approximately $10.00 from Jim Jones, 36631 Ledgestone, Mt. Clemens, MI 43043. Straight-grained wood strips are best and this re-emphasizes the need for careful wood selection.

This model was designed with an eye to maximum efficiency from a minimum of materials. The wing and stabilizer, for instance, are built up from strip stock, using what has been called the "cracked rib" or "California rib" construction. Basically, this technique involves the use of conventional leading and trailing edges, together with a notched main spar to which strip stock is attached. The bottom of the flying surface is flat and the top is formed by taking strip stock from the top of the main spar to the leading and trailing edges respectively. The "airfoil" is completed by adding a "turbulator spar," of tapered strip stock, half way between the main spar and the leading edge.

The wing should be built with wash-out at each tip. (When the leading edge is flat on the plan, the outboard tip of the trailing edge is propped up approximately 3/16 in. so that it gradually increases making a stabilizing "warp" in each half of the wing.) I have built several wings of this type and all have performed well. Being essentially



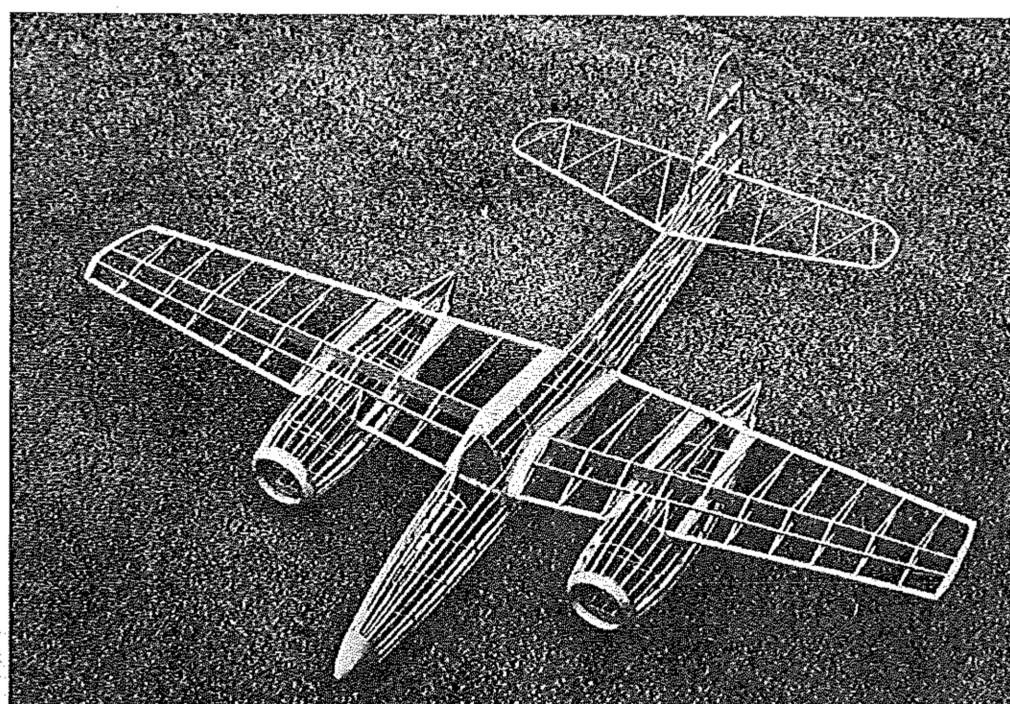
FULL SIZE PLANS AVAILABLE . SEE PAGE 128

a collection of flat surfaces, a wing constructed in this fashion is particularly suited to an aircraft with a wood or metal skin as the tissue covering is allowed to stretch flat eliminating the "peaks and valleys" associated with the covering of a wing built using conventional ribs. This technique also uses a minimum of material and, as a result, is light.

The fuselage and nacelles are also designed to use materials sparingly. Only the formers located at anticipated positions of stress are made from sheet balsa. All other formers are laminated from thinly cut strip stock.

Stabilizer: Tradition dictates that the building of a new model start with one of its less complicated components so as to give the builder a feeling of the construction technique involved. With this in mind, select or cut a length of ⅛" sq. stock (fairly hard) for the stabilizer's leading edge. Position this over the plan, mark the rib locations, and then notch the leading edge to receive a 1/16" sq. strip which will serve as the stabilizer's ribs. Similarly, the stabilizer's spar is cut from straight-grain stock (1/16" or 1/20" thickness) and the trailing edge is 1/16 x ⅛". Both the stab spar and the trailing edge are notched to receive the 1/16" sq. stabilizer ribs.

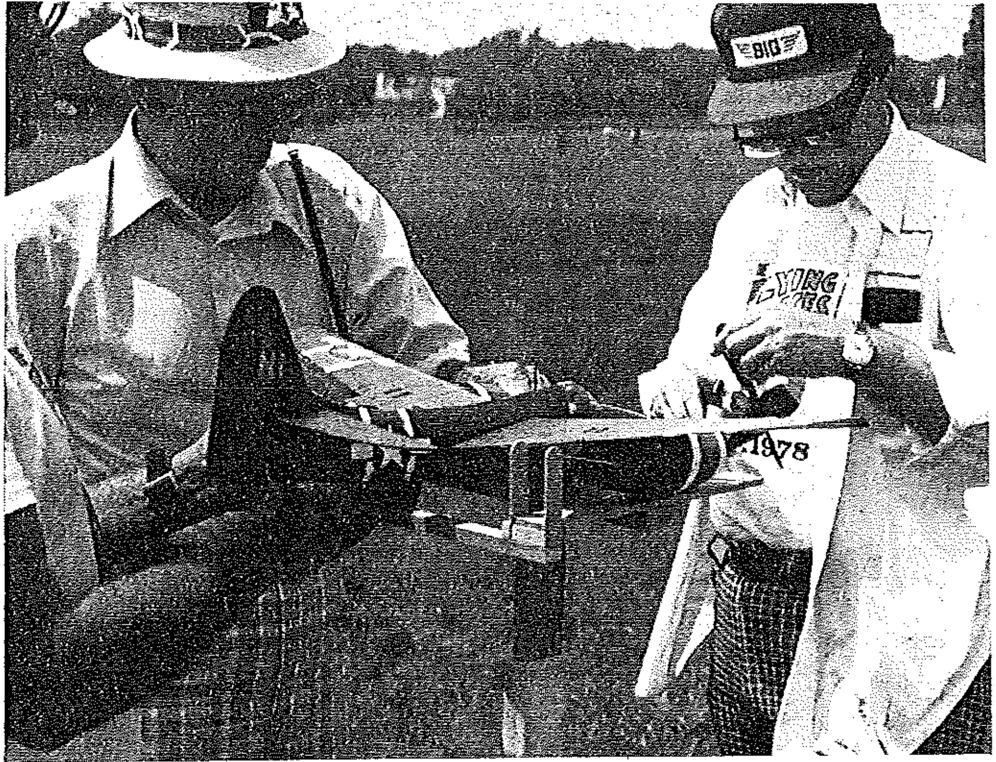
Place the notched trailing and leading edges directly over the plan, securing them to the building surface with straight pins. The tips may be either laminated from 1/16 X 1/64" or may be cut from light 1/16" sheet. Add the 1/16" stabilizer rib bottoms. Next, add the stabilizer spar and, using 1/16" square stock, construct the upper portions of the stab ribs. As the leading edge is ⅛" thick, the upper portions of the stabilizer's ribs may be simply fitted into the remaining



Maximum efficiency is obtained by minimum use of materials. The wing employs the "cracked rib" or "California rib" construction. Wing cross section is basically two triangles base to base with turbulator spar on top, between main spar and leading edge. This may drive airfoil purists up the wall, but such sections have been used with complete success in radio and combat as well.

portions of the notches cut in the stabilizer's leading edge. Similarly, the upper parts of the stabilizer's ribs may fit into the notches in the spar.

The ribs are cut or broken at the stabilizer spar so that they can be joined to the trailing edge. As the trailing edge is only 1/16" thick, you will find it necessary to first cut the upper part of each



For convenience in winding two motors, this winding stand positions the plane and attaches to the two winding peg tubes in the aft portion of the nacelles. Sterling 8-in. plastic props, turned by two loops of ⅛ FAI flat rubber. The stand is fully described in the text.

stabilizer rib to a length equal to the distance from the stabilizer spar to its trailing edge. To avoid a bumpy trailing edge, remove each upper part of the stabilizer rib, and cut the underside of the rear part to an acute angle so that it has greater surface contact with the 1/16" sq. bottom portion of the rib. The upper surface of the ribs now should blend smoothly with the trailing edge and require little, if any, sanding to complete the airfoil shape.

Next, add the stabilizer's turbulator spar of hard 1/20 square or 1/16 sq. strip stock. When dry, round the leading edge and tips and taper the trailing edge and turbulator spar.

Wing: Following the basic technique described for the stabilizer, carefully select pieces of 3/32 X ¼" strip stock and notch them at the places shown on the plan for the wing's trailing edge. The leading edge is constructed somewhat differently, in that a piece of 1/16 sq. is butted against a piece of ⅛ sq. for greater strength. The 1/16 portion of the leading edge is then notched to receive the flat bottom pieces of the wing's ribs. The main spar is cut from 1/16 sheet and notched as shown on the plan.

Begin wing construction by positioning and securing the notched leading and trailing edges. Next cut pieces of 1/16 sq. which are fitted into the appropriate notches, thus joining the leading and trailing edges. Before joining these pieces permanently, however, place a strip of 3/16 thick stock at the outer tip of the trailing edge. This will give you a built in wash-out for greater stability. Then glue the 1/16 sq. bottom portions of the ribs to the leading and trailing edges.

Next, position the main spar over the plan and glue it to the 1/16 sq. lower portions of each wing rib. The upper portions of each wing rib are then fashioned from 1/16 sq. in a manner similar to that described for the stab. With all the upper portions of the ribs in place, glue the turbulator spar in place as shown. Finish by adding the tip, made either from 1/16 sheet stock or laminated. In either event, it will be necessary to break the wing tip so that it goes from the trailing edge to the upper portion of the main spar. The tip then goes from the upper portion of the main spar to the tip of the turbulator spar and from the turbulator spar down the leading edge.

Round the leading edge and wing tips and taper the trailing edge.

Fuselage: This design seeks to use a minimum of materials with maximum effect. Accordingly, only formers F-1, F-5, F-6 (all cut from 1/16 sheet) and F-8, F-9 and F-12 (all cut from 1/32 sheet) are from sheet wood. These formers are in positions requiring strength and are left solid. Notice that each former is notched to receive longerons and stringers. These formers "key" the location of the fuselage's longitudinal structural members. The remaining formers, as shown on the plan, are laminated so as to form supports for the stringers, etc., at those place not requiring high structural strength. The fuselage and fin portion of the vertical stabilizer are built as one unit.

To keep the basic fuselage shape true, it is suggested that it be built on a jig. For the original, the jig was simply a piece of ⅛" masonite on which the fuselage profile was drawn. The locations of the formers were then cut away. The bottom 1/16 X ⅛" keel, after having approximately 1/16" deep notches cut to receive the hollow formers, was then fastened to the masonite jig using bits of masking tape. The jig can be placed in a vise or nailed to the edge of your workbench. Next, the solid formers (F-1, F-5, F-6, F-8, F-9 and F-12) are positioned on the bottom keel and the top keel added. The formers are glued in place, using a small plastic triangle to square them with the keel.

The 1/16 undersized built-up formers are constructed by cutting 1/64 strips from 1/16 sheet. Four of these strips are joined and bent around to the shape shown on the plan to create a hollow former. Once positioned, the laminated pieces are cemented, using Zap cyanoacrylic glue. Each hollow is completed by adding 1/16 sq. cross braces as shown on the plan.

The hollow formers are fitted into the keel structure and cemented with either white glue or model cement, due to the minimal surface contact. Next, 1/16 X ⅛" side longerons are cut, notched and fitted into place. The longerons fit snugly in the solid formers but merely touch the hollow formers. Cyanoacrylic glue is used to cement the longerons to the solid formers, but in view of the minimal surface contact, either white glue or model airplane cement is used to attach the hollow formers to the longerons.

Stringers are added by fitting them into the notches cut in the solid formers, and by gluing them with white glue or model cement to the hollow formers. Building the fuselage in this fashion, all but the uppermost and lowermost stringers are in position before the fuselage frame is removed from the masonite jig. Those final stringers are added once the fuselage is removed

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The fully wound port motor being attached to the shaft hook. Tissue is damp-shrunk and in keeping with the lightweight design philosophy, only one coat of clear is applied. Basic color is typical Navy dark blue, with green and white bands. Color is misted on with spray gun.

on a halftone photo merely enlarges the dots. A really sharp photo can be magnified to read stenciled legends on the plane and to locate panel lines. Best source of photos is the modeler's camera, if the prototype can be found. Dedicated researchers travel great distances and spend days photographing and measuring a plane.

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from the jig.

As indicated by the shape of former F-12, the vertical tail is of tapered thickness. The two horizontal ribs in the fin are cut from scrap 1/20 or 1/16 sheet stock, and tapered from a width equal to that of F-12 where they join it, down to the thickness of the fin's leading edge. Also, the contour of the upper fuselage immediately behind the cockpit is somewhat rounded and it is suggested that the area between formers F-5 and F-7 be filled in with tapering pieces of 1/16 sheet, sanded and rounded to better approximate the look of the full-size aircraft. The rudder (moveable part of the vertical tail) is built separately.

Nacelles: Using the same techniques described for constructing the fuselage, the nacelle formers and longerons are cut and then assembled on a masonite jig to hold them true while being assembled. As the nacelles "mirror" each other you will have to flip the formers shown on the plan to make the left nacelle.

Component Assembly: The wing halves are joined to the fuselage center in such a way that the leading edge of each half of the wing is joined in front of former F-5. The main spars meet just behind former F-6, and the trailing edges join at former F-8. It will be necessary to deeply notch F-8 to permit the trailing edges to pass through it. It will also be necessary to remove portions of the fuselage stringers where they block passage of the main spar. The approximate dihedral angle has been indicated on formers F-5 and F-6 and will help in aligning the wing halves. The dihedral on the full-size aircraft is substantial and the dihedral on the model is approximately 1⅜ in. at each tip rib.

Once the wing halves are positioned so that the leading and trailing edges and the main spar all meet as indicated, the two halves are joined together with epoxy. Before the wing is joined to the fuselage, check that it has approximately two degrees positive incidence (use the side longeron as a reference line). The wing then is joined permanently to the fuselage, using epoxy and scrap balsa to fill any gaps between the wing and nearby supporting fuselage formers.

The area between the root rib and the fuselage is filled in with 1/32" sheet, both for strength and as a base for adhering the tissue covering. Similarly, 1/32 X ⅛ strip pieces are installed, following the shape of the airfoil in those portions of the fuselage adjacent to the wing root. This adds strength and also provides a suitable base for the tissue attachment.

Each of the nacelles is joined to the wing at the position shown on the plan. The angled tops of formers N-4, N-5, N-6 and N-7 are aligned with the underside of the wing. The trailing edge is epoxied to N-7, while the leading edge is joined to N-3 as shown. Once the nacelle is in place, fill in an area between the nacelle and the underside of each wing rib nearest to it with 1/32 sheet. There is no need to put 1/32 sheet fill on the top surfaces of the wing, except for that portion between N-3 and the turbulator spar.

Landing Gear: As indicated on the plan, landing gear for this model is optional. Flying Aces' Rules permit subjects with retractable gear to be flown "wheels up," thus eliminating considerable weight and drag.

If you intend to place your model on static display, the landing gear may be desirable as a realistic "base" for the model. If you decide to build landing gear, it is suggested that you make it removable for flying. My favorite technique is to use a "plug in" type in which small receptacles of 1/16 aluminum tubing are placed at the points where the main landing gear members meet the fuselage or nacelles. Then the landing gear components are fashioned with 1/32 wire pins which slide into the aluminum tube receptacles. If you intend to use landing gear on your model, it is suggested that you build the appropriate receptacles for it before proceeding with the covering.

Covering and Coloring: The wing and fuselage were assembled. By using 1/32 sheet fill at key points, such as the wing roots, etc., you have strengthened stress areas and have provided anchor points for the tissue covering.

Almost all Tigercats were overall dark navy blue. My prototype is this color, but the prototype of the original aircraft was all silver. One of the first F7Fs tested at Patuxent, Maryland was all yellow. The July, 1978 issue of *Air Classics* magazine contains color photos of a civilian Tigercat in silver, red, white and black trim. I chose to mark my model with the green and white bands sported by a Marine Corps F7F at El Toro Marine Base in 1946.

In keeping with the general design philosophy, it is suggested that after shrinking the tissue, only a single coat of dope be applied.

As there is no rubber motor passing through the fuselage, you have an opportunity to install a completely detailed cockpit and full pilot figure if you wish. It is my intention to do this on my model, but the pressures of completing it for the July 15, 16, 1978 Flying Aces' National Meet dictated that I use a conventional pilot bust (which I carved from styrofoam). I have been unable to find any good detail on the F7F cockpit interior, but a fair amount of information is contained in the *Model Airplane News* book, "Best of Nye," Vol. 3. Also, an excellent reference for scale details may be had by purchasing the 1/72 Monogram plastic kit.

Propellers: I used 8" Sterling plastic propellers cut to 7½". Static three-bladed propellers were also made by using 7" Sleek Streak props epoxied at the appropriate angles. The model will probably fly on three-bladed props, but I have yet to try it.

Flying: Various motors have been tried, but thus far the best results were obtained from two 20" loops of ⅛ FAI flat rubber which I braided to better distribute the weight of the unwound motors. The rear motor pegs are short lengths of 1/16 aluminum tubing positioned at the rear of each nacelle. As the motors are considerably longer than the distance between the rear motor peg and the propeller hook, I used propeller hooks bent in such a way to give an appearance of a "Z" when viewed from behind; such a hook inhibits the tendency of a long motor to climb the propeller shaft and bind the mechanism.

I generally use a winding stooge and recommend that one be constructed. The basic stooge is a large H-shaped structure to which pieces of 1/16 plywood sheet, or portions of tongue depressors, are attached, so as to fit on either side of the rear motor peg of each nacelle. A piece of 1/32 wire is then passed through these "tongues," and through the rear motor peg, holding the unit stable while the motor is wound. The H-shaped stooge base is (at the center of the crossbar between the legs of the H) nailed or otherwise fastened to a stake which is driven into the ground.

It is possible to launch the model by holding each propeller and tossing it with both hands at once, but I prefer to use a cradle consisting of a piece of 1 X 2 pine stock to which two notched upright pieces are attached. The notches on the uprights fit over the propeller hubs and keep the motors from unwinding. This leaves me free to hold the model in the area of F-8 and F-9 with my right hand, while I hold the cradle with my left. Ready to launch, I simply pull the cradle away from the propeller and release the model in the conventional way.

My model was built to fly left under power and I found it necessary to add approximately two degrees left side- and two degrees down-thrust to each of the propellers. I found it necessary to offset the rudder approximately two degrees to the left.

Finished, but without propellers or motors, my model weighs 1½ ounces. The balance point is approximately ½" ahead of former F-6.

My model is still being test flown, but flights to date have shown it to be remarkably stable with a characteristically steep, rapid, climb under power. I had some difficulty with the stabilizer initially and I corrected this by building a thicker, lifting, stabilizer. Unfortunately, at the time of the Flying Aces Nats I had not yet appreciated the nose-down effect of a lifting stabilizer with the result that, although my model climbed well under power, it went into a steep dive from altitude, limiting my flight time to only 30 seconds. I believe this design is capable of one minute flights.

By changing the elevator angle of attack (giving it more "up" elevator), I have countered its lifting tendencies and considerably improved the glide. My best flight time since making these adjustments has been 44 seconds which was obtained at Wright-Patterson Air Force Base on September 24, 1978. With a little more tinkering and a thermal, who knows. . . .

Stolen: From van at Ames Department Store, Athens, PA—Red / white / blue Aeromaster, Kraft 7-ch. 2-stick, O.S. Blackhead 60; flight box 12V battery / power panel / tools; Kraft 5-ch. receiver and servos, K&B 3.5cc; RC Nobler kit, Excalibur kit, miscellaneous planes, balsa. Contact: Dale Lant, RD 1, Box 43-C, Nichols, NY 13812 (Tel: 1-607-699-3144), or Athens Police Dept. (Tel: 1-717-885-1401).

FF Indoor/Tenny

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thermals, and there are things such as thermal inversions which may *appear* to affect model performance in unpredictable fashion. Only the really skilled fliers know how to use these factors in predictable ways.

What Else? Well, when the international "flimsies" are put away, the First World Peanut Gran Prix will be held, sponsored by Doc Martin's *Miami Indoor Airplane Model Association.* This Peanut Scale contest will be CDed (or directed, or whatever) by Butch Hadland, from the UK. The rest of the week (that's right—a whole week) will be taken by NIMAS for the Fifth NIMAS Annual Record Trials (VNART). The VNART formula may be changed somewhat this year, but all those details remain to be worked out. Anyone who misses this week of modeling will regret it!

CO_2 Models? It has been mentioned before in this column that the newest and very tiny CO_2 engines are turning up in indoor models. Photo 1 shows a very nice CO_2 powered indoor scale model; a Stearman PT-17 by Bob Siedentopf of Hammond, IN. The model was flown at the annual Midwest Indoor Championships held in Chicago, IL. Although indoor purists doubtless will be very nervous over the intrusion of CO_2 models into their airspace, this technology is a very interesting type of flying.

Model Boxes. The mention of a World Championship brings forth thoughts of model transportation problems. Everyone who has