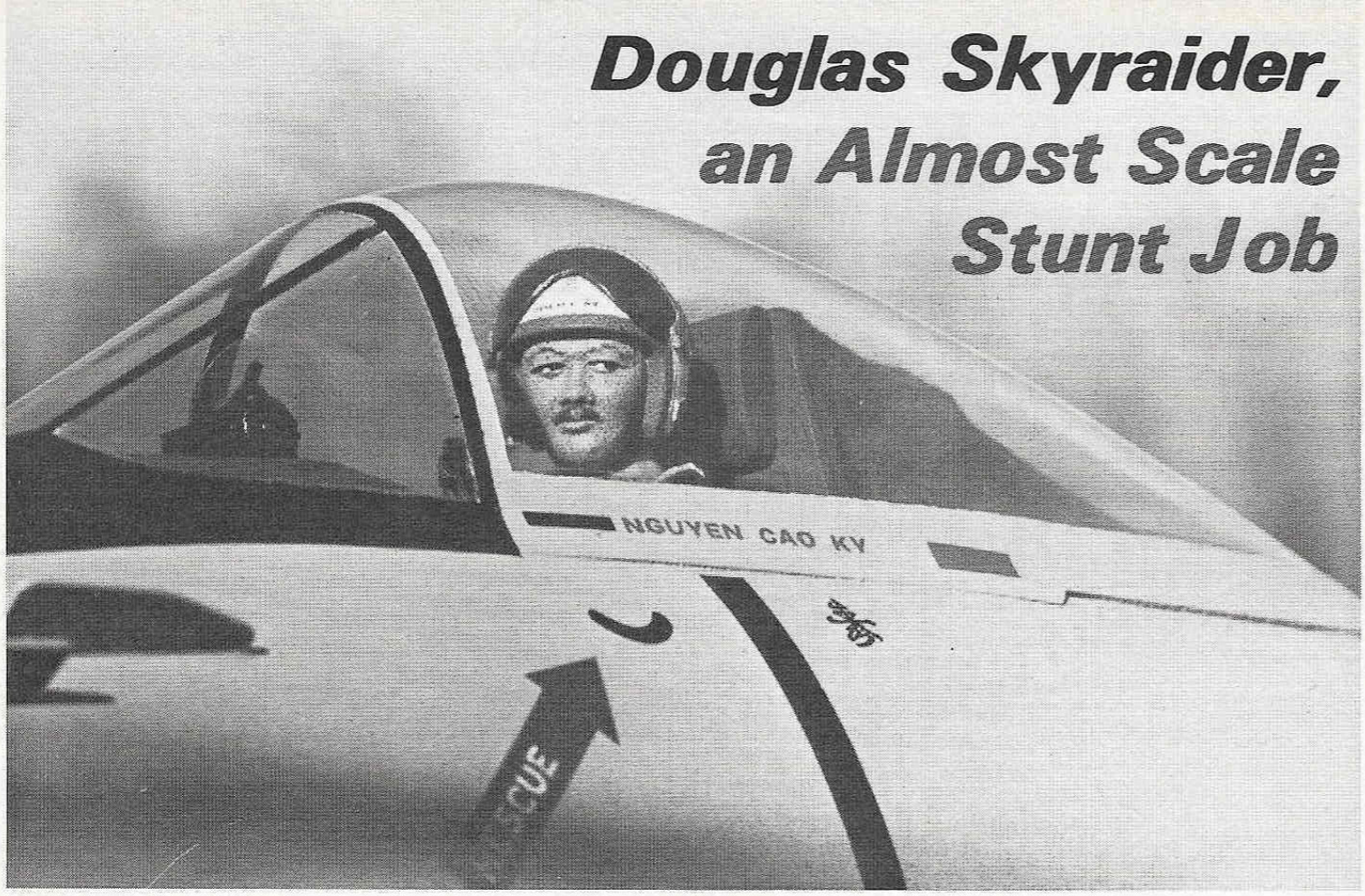
Douglas Skyraider, an Almost Scale Stunt Job



General Nguyen Cao Ky stares from the cockpit of this beautiful "Skyraider" rendition, a Controline Stunt design to blow your mind. Super Tigre .35 thrust in a 48 ounce bird. A molded cowl, and how to do it!

Don started out with a Williams Bros. 1"-1' pilot bust, modifying it with plastic model customizing putty to resemble press photos of South Vietnam's General Nguyen Cao Ky. A remarkable likeness! Oxygen mask, rip-cord added. Right: Williams Wright engine cylinders in cowl.

Photos by Budd Davisson

by Don Typond

What do you do if you're a Scale nut but also enjoy flying Controline Stunt? Well, there have been "Semi-Scale" stunters from time to time, but frankly most of them weren't much more realistic than *Nobler's* with camouflage paint jobs. Then along came Al Rabe with his now well-known *Mustang* and *Bearcat* models, and recently there's been a rash of very realistic Stunt ships.

When I admitted that I could resist the temptation no longer, the next question was what airplane to use as a subject? I have this thing against putting propellers on distorted jet fighters—which seems to be the trend right now—so it had to be a prop job. Moreover, because I wanted the model to be as close to scale as possible, the prototype had to have near-stunt proportions to begin with.

The Douglas *Skyraider* is just about perfect. It has a big wing, huge tail surfaces, the right force moments, conventional landing gear...and besides, I like it. A bit of slide rule work showed that the wingspan could be scaled 1" to the foot for a 50" span, while 15/16" to the foot would proportion the fuselage properly. An increase in wing chord was necessary of course, and the flap span was increased as well, but in general it worked out to be an Almost Scale model at, for all practical purposes, 1" to the foot.

Another reason for the choice was that I'd always had this strange notion that not only should a scale pilot be installed in a Scale or Semi-Scale model, but that he should be as scale as the airplane. What I mean is this; many builders detail their models to duplicate a specific airplane flown by a specific pilot, but no attempt is made to make the dummy pilot resemble the real guy. There's good reason for this, of course. Many times there aren't any photographs of the pilot to use as a guide, and in most cases even if you did make your dummy pilot look like the real person, nobody would recognize him anyway. However, Vietnamese General Nguyen Cao Ky is well-known, and many of us have seen him in newspaper photos and on television. He happens to have flown an AD, and the markings of his personal aircraft are shown in the Profile publication on the *Skyraider*. So, with a Williams military pilot and a tube of plastic model customizing putty, I managed to get a reasonable likeness of General Ky to put in the cockpit of "his" Vietnamese Air Force *Skyraider*.

Because of the massiveness of the fuselage, and the fact that the wing is fully sheeted, the model must be built of the lightest balsa you can get. Balsa weight is expressed in terms of pounds per cubic foot, and ranges from approximately 4 pounds to over 12 pounds. Commonly available balsa usually found in hobby shop racks is usually between 7 and 10 pounds. Unless your local shop caters to contest Free-Flight builders, it probably doesn't stock light wood, but should be able to get it on special order. Almost all the balsa used in the *Skyraider*, with the exception of fuselage stringers and wing spar, was approximately 5 pound stock. It was ordered from Sig, and is marked, "Contest Balsa, Very Light 4-6 lb. Stock." Experience has shown that most of it is between 5 and 5.5 pounds.

I strongly suggest you make an effort to obtain special stock, since it's doubtful that even the lightest wood in the shop rack will be less than 7 pounds. I used almost 20 ounces of balsa in the *Skyraider*, which means that if it had been 7-8 pound stock instead of 5 pound, I could have added up to 10 ounces of weight. As it is the model is reasonable for its size at 48 ounces ready to fly, but would have been quite heavy at 58 ounces. It becomes obvious that the *only* way to build a light model is to begin with light wood.

(It might be appropriate at this time to clear up possible confusion about balsa terminology. The term "contest" balsa does not necessarily mean "lightweight" balsa, but some people use the two interchangeably. In reality, I have some wood marked "Contest Balsa, 8-12 lb. Stock." In short, some suppliers use the word "contest" to indicate top quality regardless of weight, others use it to mean light weight, and

still others use it because it sounds good. The only way you can be sure of getting light wood is to order it by weight designation, and/or to weigh it yourself. In this regard it's almost mandatory that you use a gram scale, one gram being approximately 1/28 ounce. A sheet of balsa 1/32"x3"x 36" will weigh: 4 lb., 3.5 gm; 5 lb., 4.4 gm; 6 lb., 5.25 gm; 7 lb., 6.12 gm. For weights of 1/16" stock multiply by two, 1/8" stock multiply by four, and so on.)

Wing Construction

Begin construction with the wing. I made mine removable, using typical R/C procedure and hardware, in order to transport the model in a small car, and to make it easier to handle while painting. If you don't have space problems, attach your wing permanently.

Make an aluminum or plywood template and cut the strip ribs from 1/16" stock, each rib being 1/4" deep. Cut the tip and root ribs, and notch them half-depth for the spar. (Leadout holes are not needed on starboard wing ribs.)

The spar is made from 1/8" medium (7-8 lb.) balsa, in two pieces joined at the root. Note: Wingspan is symmetrical. Join the spar halves together and add 1/32" ply webs front and rear, using epoxy cement to avoid warping. Install tip and root ribs, making sure they are perfectly square to the spar.

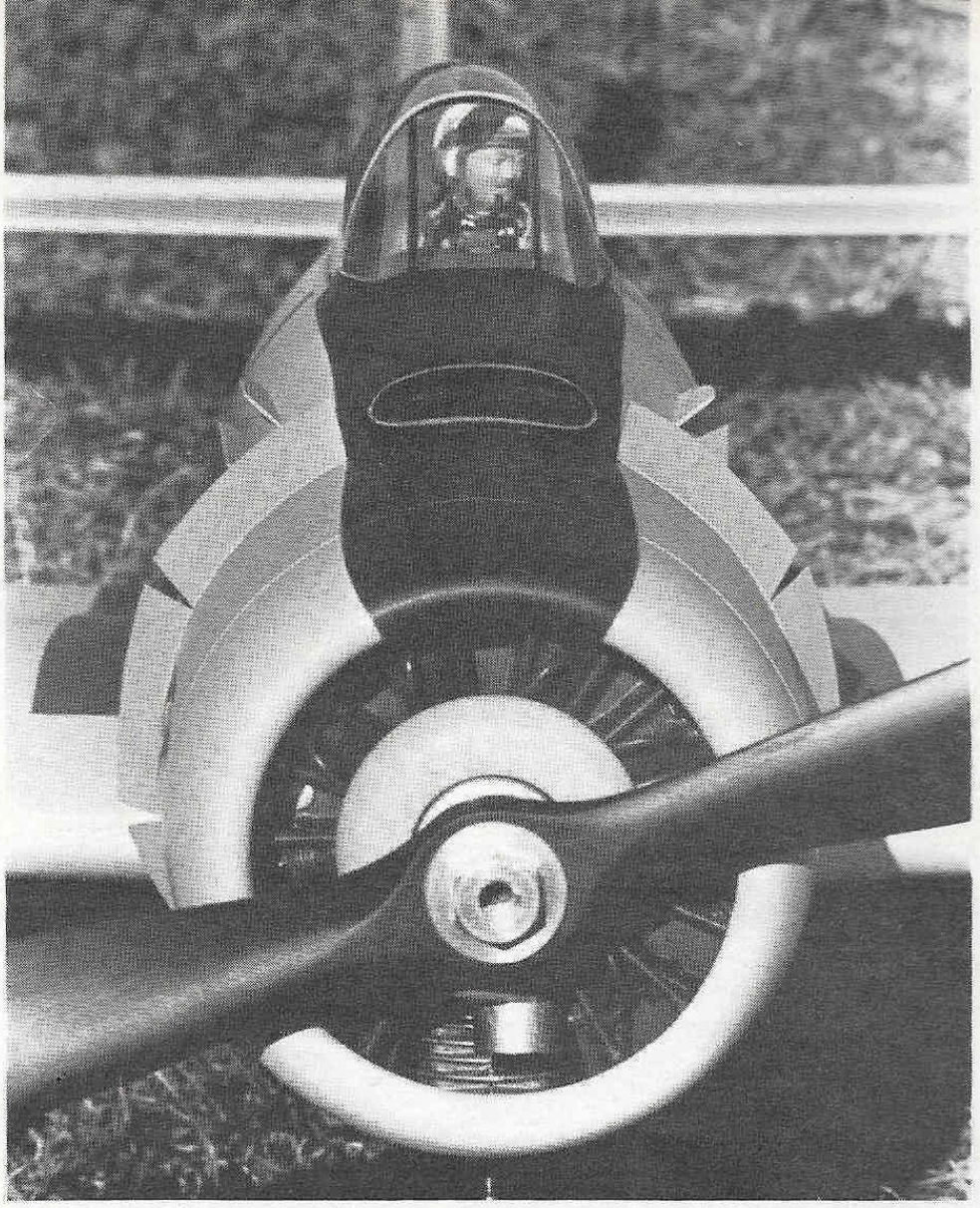
Because the wing is tapered and has dihedral, it would be best to construct a jig to hold it in alignment, but it's not absolutely necessary. Install the 1/2" square leading edge by gluing it to the tip and root ribs and making a splice joint at the center. Install the 1/4" square trailing edge in the same manner. Now block the wing frame in a level position on your bench using scrap balsa and pins, checking alignment to eliminate any warp.

Install strip ribs by cutting the leading edge to proper angle and trimming excess length from the trailing edge. Glue each rib to the leading edge, into its spar notch, and to the trailing edge. When the top surface is complete, turn the wing over, reblock it to straight and level, and install bottom ribs. Note that the top and bottom ribs overlap at the trailing edge and should be glued to each other as well as to the trailing edge.

Now add center-section filler blocks to leading and trailing edges, epoxy the maple bellcrank mount to the spar, and install bellcrank and leadouts. Fabricate the landing gear legs and plywood mounting plates and epoxy them into the wing. The 1/8" ply plate is first glued to the leading edge and the spar, then the various 1/16" ply plates are added to lock it into position.

Re-align the frame with blocks and pins, then sheet the upper surface with 1/16" balsa. A point about adhesives: To prevent planking from sagging between ribs and/or formers, always use a non-shrinking glue such as epoxy, white glue, or aliphatic resins like Titebond. Sagging occurs when acetate-type glues shrink, pulling the planking down on either side of the rib or former, a condition which is further aggravated by the subsequent shrinking of the dope finish. Non-shrink glues will reduce this problem considerably.

I used Hobbypoxy Formula II which gave me plenty of time to insure that the planking was firmly attached to each rib, without the bulging that can be caused by water-swelling of the balsa when using white or aliphatic glue. When the top surface is complete, turn the wing over, block it, and sheet the bottom. Be sure that the wing is in perfect alignment, because once the bottom sheeting goes on, any warps are there to stay.



Cut a window in the top planking over the bellcrank area, then rough-shape and hollow the tip blocks and glue them in place, adding one ounce of weight to the outboard tip. Reinforce the planking centerline joint with nylon tape and epoxy.

Make flap horn and pushrod assembly as shown on plan, and wrap and solder all joints. Attach horn bearings to trailing edge and hook pushrod to bellcrank.

Construct the flaps and "ailerons" as shown on plan, and glue ailerons in place. Drill flaps for control horns and cut slots for the hinges, but do not attach flaps permanently at this time. Finish carve the tips to fair into wing and aileron surfaces and sand smooth.

Do not install dowel pegs in the leading edge yet. They will be located during fuselage assembly to insure correct alignment. Also, do not drill holes for rear mounting screws yet either, for the same reason.

The Tail

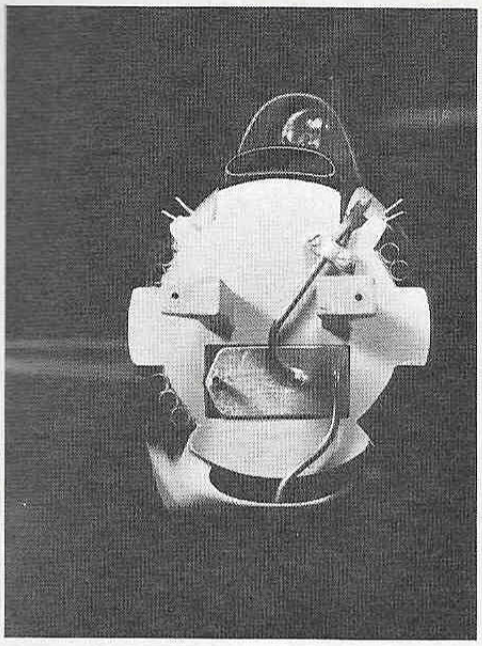
The stabilizer and elevators are built-up, using 1/32" skins for lightness. The stab frame is built by assembling the leading edge, trailing edge, solid center-section and ribs, sanding to airfoil shape after assembly, then adding skins. The simplest way to build the elevators is to cut the bottom skins to shape, then glue on the leading edge and triangular ribs, followed by the top skin.

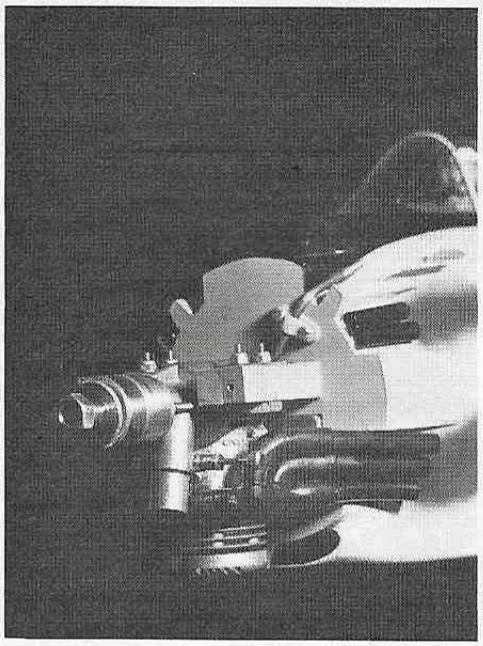
Attach a large Veco horn to the stab, using nylon tape and epoxy over the "spring" bearings. Slot surfaces for hinges, but again, do not attach permanently at this time. Add solid tips and carve to shape.

Fuselage

Begin by laminating bulkheads F-1 and F-1A, and F-2 and F-2A together. Note: The rectangular holes for the fuel tank box are positioned for the Super Tigre .35 used in the original. The ST's needle valve is further from the crank centerline than the usual 1/2" on most other engines, requiring the fuel tank centerline to be offset by a comparable distance. If you use a different engine, locate tank as required.

Slip the 3/8"x1/2" maple motor mounts through bulkheads F-2 (assembly) and F-3 and epoxy in place, making sure the entire assembly is perfectly square. Fabricate tank box from 1/16" balsa and glue in place. (The front end of the box is open, and the tank is removable from the front of the firewall. I prefer not to enclose the tank permanently in case corrosion or leakage requires later replacement. For this procedure, the tank vent and filler tubes must be relocated to the front face of the tank.) Now add bulkhead F-1.





A Veco four ounce tank is recommended, with tubes relocated in front end plate. Copper tubing is easier to bend than brass. Filler tube is hidden when cowl is in place. Overflow dumps behind cylinder. Right above and below: Super Tigre .35 equipped with brass tubing manifold for scale exhaust outlet. Fuel filler tube held to firewall with nylon landing gear bracket. Dummy exhaust pipes are aluminum tubing epoxied to fuselage. Front end is a focal point, detail it well.

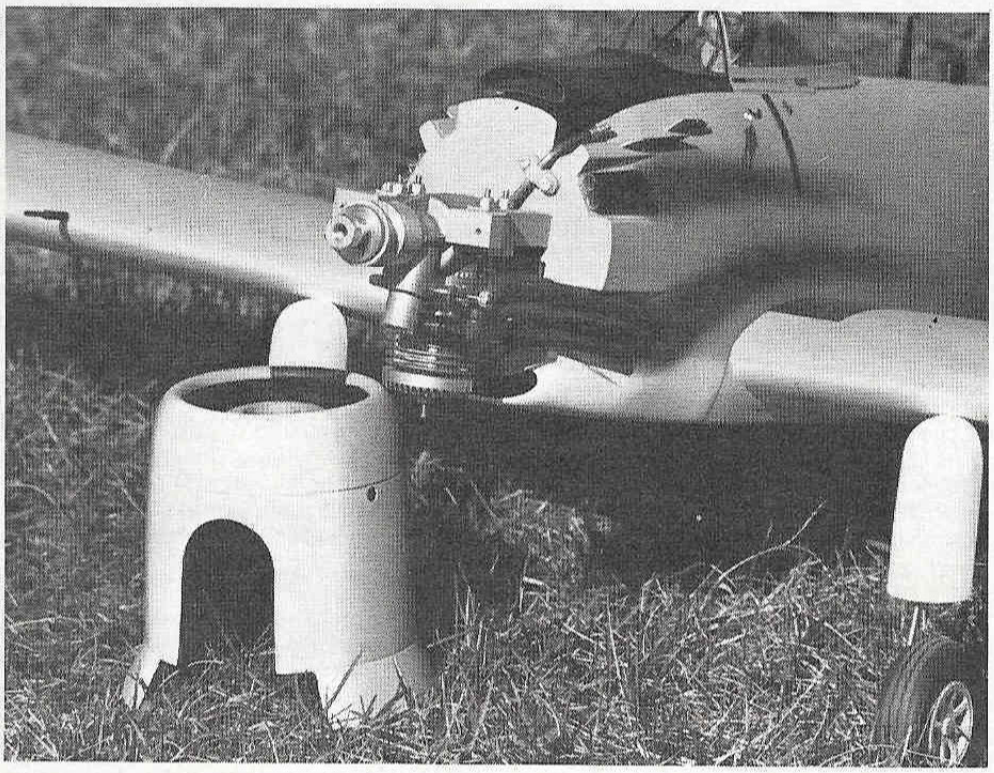
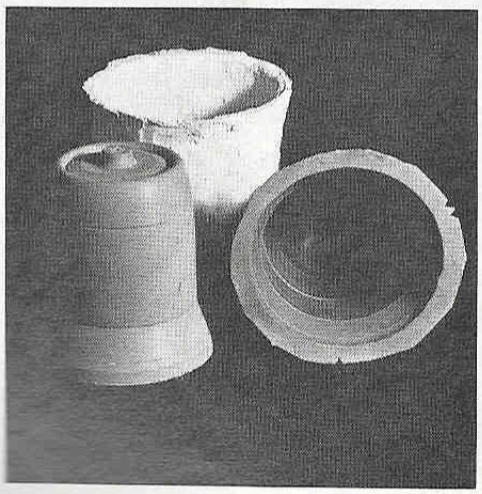
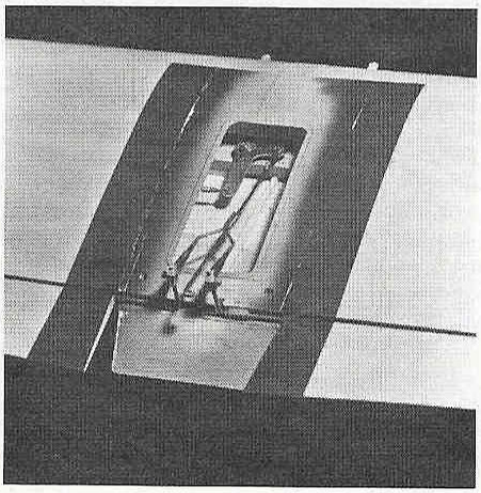


Photo below: The male plug for the cowling was turned on a lathe. Latex mold at right created from the male mold and the "plaster pot" supports the latex mold when laying up fibreglass.



Below: The center-section showing bellcrank and control horn details, location of hatch cut in top planking. All holes in bellcrank are well bushed for smoother operation and longer life.



Cut the doublers from 1/8" sheet, using the strip rib template to cut an accurate contour for the wing saddle. Place the doublers on the wing and trim for a perfect fit. The next step is very important for true alignment of the wing to fuselage, so follow closely: Block the wing up on your bench so it's level, checking height of the leading and trailing edges above the bench to insure that the airfoil centerline is perfectly horizontal. Now pin, tape, or spot glue the doublers in position on the wing, making sure they're equidistant from the wing centerline and parallel to each other. Block the front end assembly (motor mounts and bulkheads) in position, with bulkhead F-3 tight against the wing leading edge. Check to see that the motor mounts are perfectly horizontal, which will insure that the engine thrustline is parallel to the airfoil. Now epoxy the doublers to bulkheads F-2 and F-3.

While everything is still in position, use a sharp pencil, or better yet a short piece of 1/4" O.D. brass tubing with the end sharpened, and mark the position of the wing peg holes in the leading edge. Bolt the nylon wing mount blocks to the 1/16" plywood plates, and epoxy them to the inside faces of the doublers. Now sharpen one of the nylon screws that come with the wing mounts, and screw it through the blocks from the top until the point marks a spot on the wing. This will provide accurate location of the bolt holes.

Add F-4, F-5, and F-6, then remove fuselage assembly from wing. Bevel the rear portion of the doublers as shown on the top view of the plan.

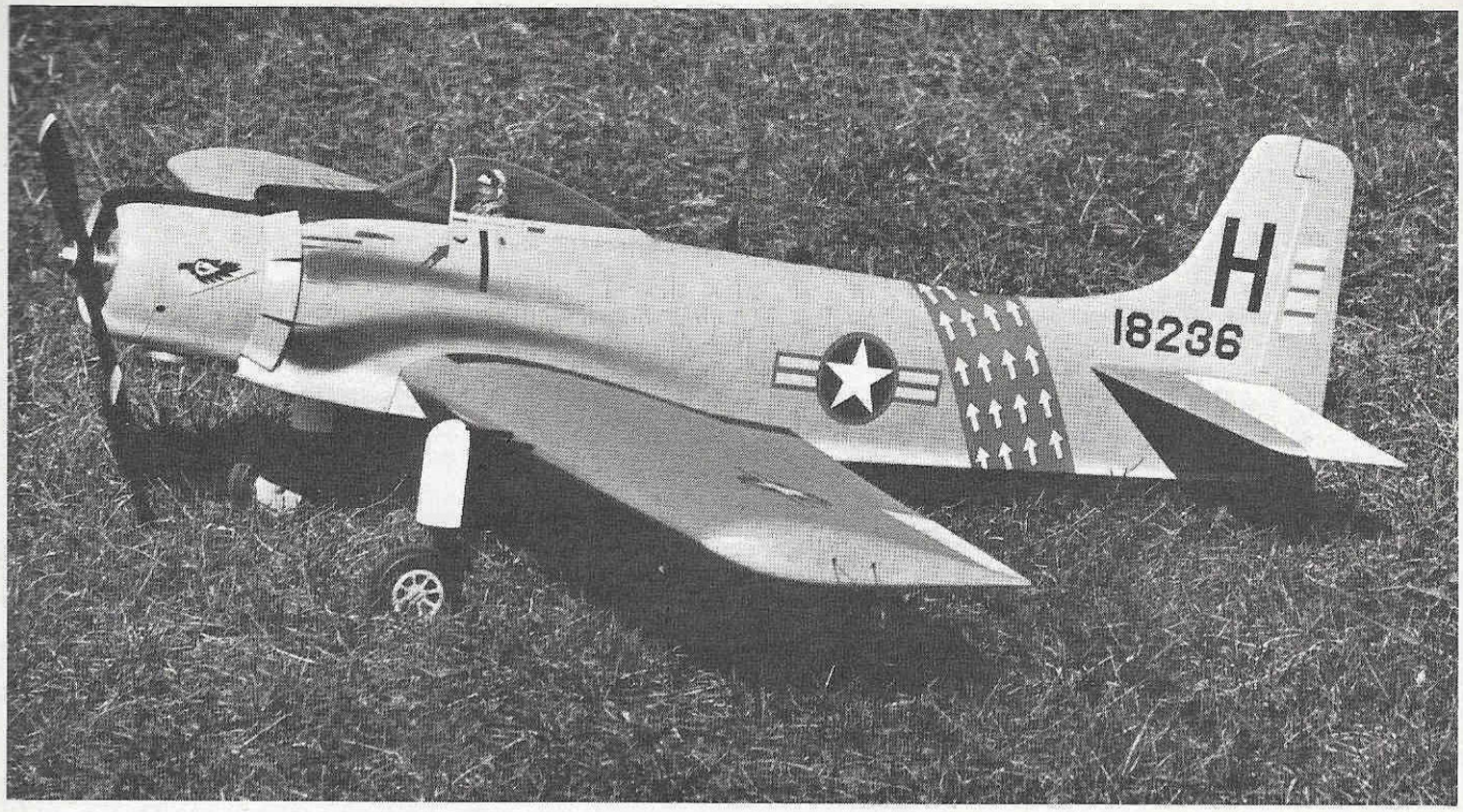
Now add the 3/32" side planking to the forward portion of the fuselage, bonding it firmly to the doublers. Note that this side planking extends below the doubler to the bottom of the fuselage between F-2 and F-3. Add the 3/32" sides to the aft end of the fuselage, bonding firmly to the beveled face of the doubler.

Add the remainder of the bulkheads, taking care that the fuselage does not bend to one side or the other. Attach small balsa blocks to F-9 and F-10 on which the stabilizer rests, then install the stabilizer.

Begin planking the fuselage in the area between F-1 and F-2. This section has the identations for the exhaust pipes and must be planked in bits and pieces using 3/32" sheet. Next lay in the long tapered piece of 3/32" planking that runs under the stab from F-10 forward to F-2. You'll have to use a bit of judicious pinning and taping to get it to bend around the "corner" at F-6. Be sure to glue the edge of this planking to the undersurface of the stab, then insert triangular-stock gussets up through the bottom of the fuselage to firmly fix the stab to the fuselage sides.

Now add the cockpit floor, the triangular piece just aft of the cockpit opening between F-4 and F-5, the 1/4" square stringer on top, the dorsal former, and the 3/32" sheet fin keel. Glue in the turtle-deck stringers, rudder post strips, fin ribs (1/16" sheet sanded to airfoil after they're in place), and triangular corner stringers along bottom of fuselage.

The elevator pushrod should be installed at this time. Make an "L" bend at one end of the 1/16" dia. wire; this bend engages the brass tubing on the flap pushrod assembly and is retained by a 1/16" set-screw



Markings are those of the Vietnamese Air Force Skyraider once flown by General Nguyen Cao Ky. Design is superbly proportioned for modeling.

wheel collar. Solder a threaded Kwik-Link coupler on the other end, and attach a Kwik-Link. Now bind the 1/8" dia. dowel stiffener to the pushrod, using thread and glue. This type of assembly is stiffer and lighter than a solid piece of 3/32" dia. wire. Attach rod to the elevator horn.

The remainder of the planking is put on now; 3/32" sheet from F-2 to F-5, and 1/16" sheet on the turtledeck. The fin is covered with 1/16" sheet with the grain running vertical. Install the tail-wheel mount and plank the bottom with 3/32" sheet. Now sand the entire fuselage, blending the planking where the 3/32" meets the 1/16".

Glue balsa blocks to top and bottom of nose section and carve to shape of air scoops. Make rudder from very light 3/8" sheet and glue to fin.

Now return to the wing and drill leading edge for 1/4" dia. dowels and trailing edge for mounting bolts. Mount wing to fuselage and build bottom portion of fuselage directly on the wing. No patterns are given for the sheet parts in this area; cut and fit to shape required to match the contour of the fuselage.

The Cowling

The cowl on the original is made of fiber glass. First a male plug was turned on a lathe, and given a few coats of primer. A plaster female mold can be made directly on this plug, but because of the depth of the cowl and lack of appreciable draft angle, I preferred to make a rubber mold. Liquid latex (available in art supply and crafts shops) is painted on in successive coats until it's approximately 1/16" thick. Then, while the rubber mold is still on the plug, a layer of plaster about 1/2" thick is built up over the rubber. When dry, the plaster "pot" is removed and the rubber mold peeled off the plug. Replace the mold in the plaster pot, which serves to support the rather floppy rubber in proper shape.

Paint a coat of polyester resin in the mold and let it cure. Then fit a single layer of four-ounce fiber glass cloth into the mold and thoroughly impregnate it with resin, working out any air bubbles. When the fiber glass layup is cured, peel the mold off and trim excess cloth away, then cut the cowl flap notches and engine clearance hole with a razor saw. Install a plywood disc on the inside, located so it's flush with the front of the motor mounts when the cowl is in position. Cut a slot in the disc to admit cooling air to the engine, and add dummy cylinders if you care to. The cowl is held in place with sheet metal screws driven into the motor mounts. The original required a small hole for needle valve access, but no exhaust slot was needed as the exhaust was carried out through the scale location via a brass manifold beautifully fabricated by John Ciesla, owner of the Hobby Hut in Pompton Plains, New Jersey.

Finish

Paint all bare wood with as many coats of thinned clear dope as is necessary to build a slight gloss. It's preferable to thin the dope with about 50% thinner than to brush it on full strength; thin dope penetrates the wood much deeper, strengthening the surface and providing good adhesion for the final finish. On a sheeted structure I use Sig Litecoat in order to reduce shrinking and sagging of the planking; if you prefer another brand, add plasticizer.

Cover the wings, flaps, stabilizer and elevators with jap tissue, adhering the tissue with brushed on thinner.The thinner penetrates through the tissue and soften the dope underneath, bonding the tissue firmly to the wood. Cover the fuselage with lightweight Silkspan in the same manner. Brush a few extra coats of dope along the faces of the flap and elevator joints to protect against the inevitable oil that collects there, then install the hinges. Now seal the entire model with a couple of coats of clear, sprayed on.

The bubble canopy is basically a Goldberg unit, but the non-scale windshield section was cut off and replaced with one fabricated from .020" butyrate sheet. Trim the canopy and epoxy it in place, mask the clear areas, and fillet the bottom with Sig Epoxolite.

Finally, spray on a couple of light coats of color, again adding plasticizer to the dope. Trim with decals or paint, add details such as cannon and antennae, and finish up with a coat of Aero Gloss flat clear if your paint scheme calls for a flat finish.

Remember, paint adds weight, and the idea here is to get a good smooth finish in the lightest way. Warplanes didn't have a molded-plastic look anyway, so ten coats of hand rubbed dope doesn't add anything to realism. As it is, my scales indicate that the clear dope, tissue, color dope and trim added 4.2 ounces to the bare balsa airframe, and almost all of it behind the C.G. So go easy or you'll need a lot of nose ballast to balance the model.

FLYING

Assemble the model and be sure the controls work smoothly without any binding (bushing all the bellcrank and horn holes does a lot to help). Check the balance; if your engine is lighter than the Super Tigre you might need some nose weight. A tail heavy airplane will be twitchy, so when in doubt it's safer to make the first flight with a nose heavy model... you can always remove some ballast later. Because of the large cowling, a big propeller is necessary, and I've found that an 11-4 Rev-Up works well on the Super Tigre .35, running at a fast two-cycle.

Well, what are you waiting for? Build one, we need more stunt jobs that look like real airplanes. (Let's see now, a *Corsair* with segmented flaps...)