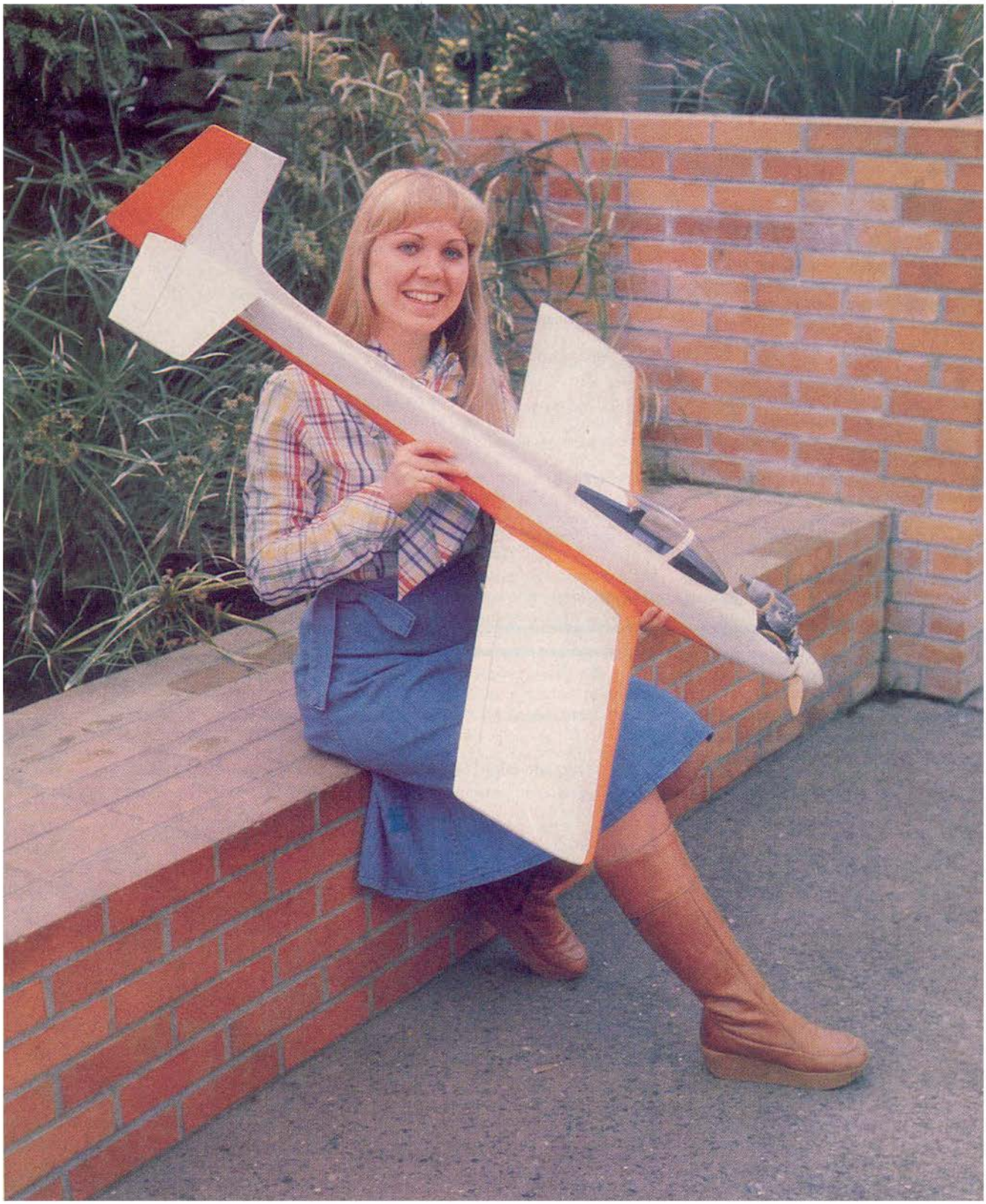


TENSILON

Here is the .40 powered aerobatic machine to beat the nitro shortage while practicing for your pattern competition.

LEFT: Showing off Duane's .40 size pattern Tensilon is Kathy Hurbis of Ann Arbor, a student at the University of Michigan.

By Duane Gall

A fellow in our club once entered a beat-up Fledgling in a pattern contest. He dubbed it "Castor Oil" just for the occasion, bragging that it would "make a lot of Phoenix flyers sick." And he did manage to place with it, thus proving two things: first, that anything is possible here in America; and second, that it's not what you fly that counts, but how you fly it. Practice is all-important, whether you're competing on a national level or just trying to hit the ground wheels first. The airplane presented here was designed to get you through many hours of practice on minimum fuel, and --- when you're ready --- to compete on a nearly equal footing with the bigger ships. I would have called it Compensator, but somebody already used that one, so I have named it after the drug Tensilon, the antidote to curare. And it flies even better than a beat-up Fledgling.

"Fine," you say, "but what about all the other .40 size airplanes on the market? Why shouldn't I just buy a Kaos 40 or a Curare 40?" Well, go ahead! But if you expect these airplanes to perform properly, be prepared to get a new Schnuerle ported engine, maybe with a tuned pipe, and a bigger fuel tank to match. The Tensilon was designed to fly with a standard .40 such as you may have sitting around the basement. It is smaller and lighter than the others, and has a few notable features to make it more efficient. If you want to know what those features are, read on; otherwise just send for the plans and make Dewey happy.

Design Philosophy

Maybe I should explain that I'm not really a pattern flyer at all, since my first love is racing. Nothing irritates me more than an airplane that dawdles around Point A when it should be kicking for Point B. And, if you hadn't heard, speed is important to an aerobatic ship because it makes deviations less apparent. (The current folly of tuned pipes and fuel pumps is an attempt to squeeze the last smidgen of speed out of those big majestic .60 ships.) So Tensilon relies on speed for smoothness. The airfoil is a 15%, sort-of-laminar section with a sharp leading edge, instead of the usual blunt, 17-18%, Kaos-type section. Now I know Mr. Bridi sat up nights developing that blunt airfoil just so the airplane would have a nice constant speed in the maneuvers. Well, mine gives constant speed too, it's just a little faster. And if you're worried about that sharp leading edge causing a "vicious stall," relax. Wing loading and balance are far more important than leading edge radius, as any pylon flyer will tell you. If you're afraid of tip stalling, just sand the outer 6" or so to a slightly larger radius. Voila! Gentle like unto a newborn lamb.

Now in my vast experience of one season of pattern flying, I've noticed that it's always windy at contests. This is no doubt due to the large vaccum created by competitors extolling the virtues of their latest handy device, or swapping tales of past glory. In any case, the wind --- or, more properly, turbulence --- tends to upset the smooth flight of an airplane. Many flyers make a habit of building heavy, massive airplanes to minimize the effect of turbulence. This is good thinking as far as it goes, but as Pappy DeBolt points out, even commercial jets will get tossed around. Since a model doesn't weigh as much as a 727, or shouldn't, anyway, there's no way we can eliminate the bumps through massiveness alone. Remember, we still have to take-off, climb, and maneuver using that little bitty engine. I believe that wing loading is the important factor here, and that a small wing is as good as another pound of lead. Tensilon has about 10% less wing area than standard .40 ships. This makes it better in the wind, with the added bonus that it doesn't mess around on landing --- nothing scary, mind you, just a noticeable absence of "float." You, too, can get it in the circle.

About The Author

Duane Gall is 22 and a student of graphic design at the University of Michigan. He has been involved in R/C modeling for eight years, including three years as a competitor in Quarter Midget Pylon. He is presently employed at Rider's Hobby Shop in Ann Arbor, Michigan. This is his second published design.

Another factor that affects performance is the tail moment. This has to do with periods of oscillation and certain prehistoric fungi, which we needn't go into here. Let's just say that longer is better, and that Tensilon has just a tad less than the big Phoenix 6.

The wing construction is slightly unusual. It is a normal foam core, but planked with leading edge sheeting and capstrips as one would plank a conventional wood structure. There is no spar or dihedral brace except for the landing gear blocks, which are bound together by the center fiberglass tape. This construction is actually lighter than a built-up structure, and has proved quite successful on racers and pattern planes alike. Besides being lighter, this method also allows adjustment of the wing after it is built, in case (Heaven forbid!) you should have a warp. Just twist the wing slightly in the desired direction while reheating the MonoKote. Be sure to use enough heat so the stuff doesn't sag a week later. There is a point, just below the melting point, where it will stabilize.

I chose the taildragger landing gear arrangement because it is aerodynamically cleaner than tricycle gear. Use skinny wheels and it's almost like having retracts. Lots of people will tell you that taildraggers are harder to handle but I think that's wrong. Properly set up, a taildragger is as docile as a trike and maybe more so. The things to look for are:

(1) Proper ground attitude. The wing should be **slightly** positive (pointed up). Bend the tailskid up or down so that in a normal landing it touches down at the same time as the mains. This will prevent porpoising.

(2) Main gear location. Bend the struts forward or backward until the plane will just remain stable when tilted onto its nose. This way the plane will transition well on a fast landing or touch-and-go. Ideally, it should not change attitude at all when it touches down. The gear may have to be bent back for flying off pavement.

(3) Slight toe-in. The front edges of the wheels should be pointing inward slightly. Don't ask me why, but this helps smooth things out too.

Generally, what I wanted was a simple but pretty airplane that would do high quality aerobatics with a normal, ordinary .40 engine. I think Tensilon fills the bill admirably. To build it, read on.

Building

The thing is only a little more complicated than a Quickie 500, so you should be able to figure everything out from the plans --- if not, write me a nasty letter. If you've never built a foam wing before, I would refer you to RCM's excellent book on the subject, in the RCM Anthology Library. Do use a good contact cement, such as Sorghum, for the wing. Horse glue don't make it on fast airplanes. I also recommend the use of a fuselage jig if you can get one. A straight fuselage is one of life's little pleasures that no one should have to do without.

The fuselage is designed around the Wing Manufacturing sport style canopy. This canopy makes an ordinary "box" fuselage into something really special, and with very little extra effort. My procedure is as follows:

(1) Build the fuselage completely up to the top deck, and round the corners as desired.

(2) Trial fit the canopy; add the dorsal fin but don't final-shape it yet. Trim the plastic flashing from both parts of the canopy.

(3) Paint the inner part of the canopy

(the piece with the dash and headrest molded in). Add the pilot, and instruments if desired.

(4) Tack the inside part to the outer (clear) part using Zap or 5-minute epoxy. Once this is done, mask off all of the assembly except the lower 1/4" or so with masking tape.

(5) Tack the assembly to the fuselage using 5-minute epoxy.

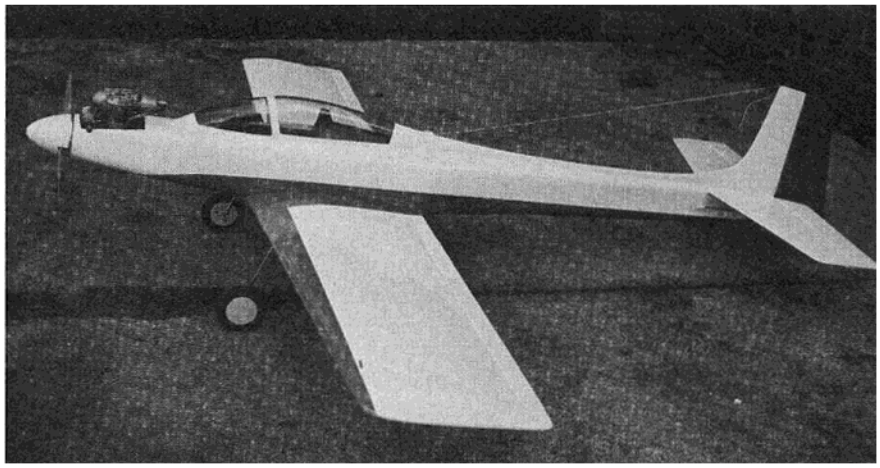
TENSILON
Designed By : Duane Gall

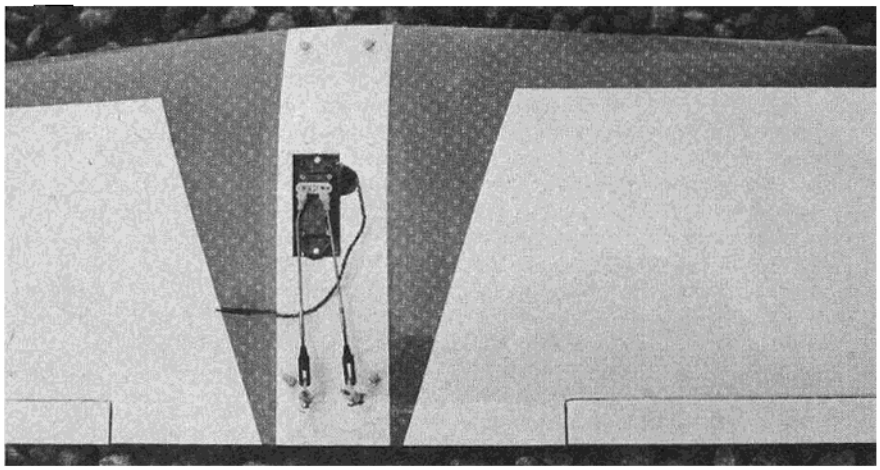
TYPE AIRCRAFT
Pattern/Sport
WINGSPAN
51 Inches
WING CHORD
Root 10" Tip 8"
TOTAL WING AREA
450 Square Inches
WING LOCATION
Low Wing
AIRFOIL
15% Symmetrical
WING PLANFORM
Swept L.E.
DIHEDRAL, EACH TIP
1/2 Inch
O.A. FUSELAGE LENGTH
47 Inches
RADIO COMPARTMENT AREA
(L) 10" x (W) 2½" x (H) 2½"
STABILIZER SPAN
20½ Inches
STABILIZER CHORD (incl. elev.)
5½ Inches
STABILIZER AREA
100 Square Inches
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
8¾ Inches
VERTICAL FIN WIDTH (incl. rud.)
5½ Inches
REC. ENGINE SIZE
.40 Cu. In.
REC. FUEL TANK SIZE
11 Ounce
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
4
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail.
BASIC MATERIALS USED IN CONSTRUCTION

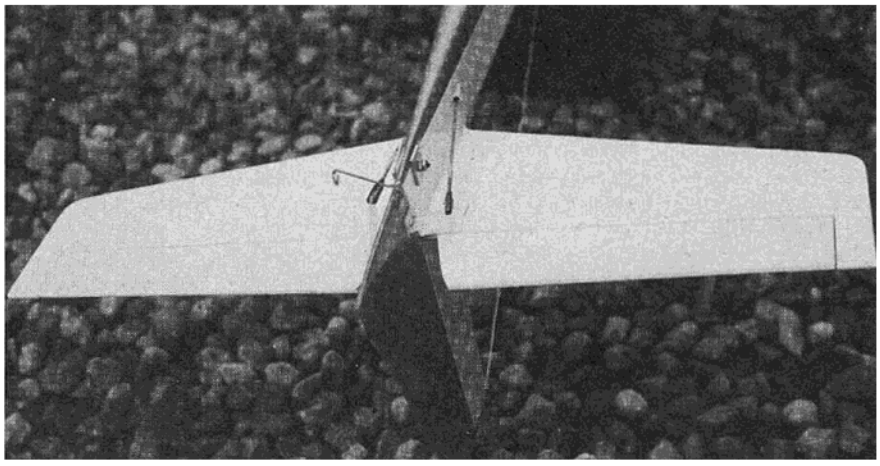
Fuselage	Balsa & Ply
Wing	Foam & Balsa
Empennage	Balsa
Weight Ready-To-Fly	64-80 Ounces
Wing Loading	22 Oz./Sq. Ft.

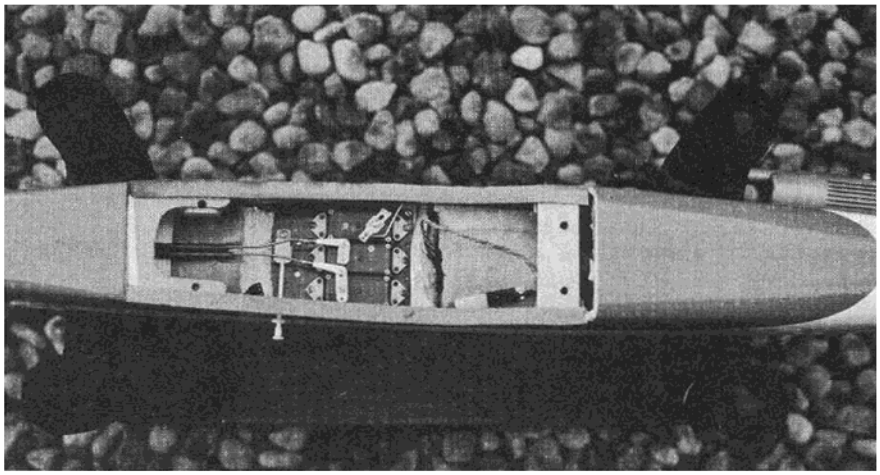
(6) Make a strong fillet around the canopy assembly using Epoxolite or a mixture of slow-setting epoxy and micro-balloon filler. Get this as smooth and uniform as you can, using a little water on your fingers to smooth it down.

(7) After th Epoxolite fillet has hardened, paint over it with a light coat of spackling paste (Dap is a good brand).









Fill in the junction where the canopy meets the dorsal fin. Carve the contours of the dorsal fin then finish sand everything down with #400 sandpaper.

The canopy framework and fillet can be painted with R & S Perfect Paint after the rest of the fuselage has been MonoKoted. Yes, R & S will stick to MonoKote --- and if you need extra peace of mind about it, try dulling the MonoKote with fine steel wool before you paint. I've found that white, dark blue, orange, and black, match quite well between the two brands. Other colors may work too --- try it and see.

The front end builds up quite simply if you follow the proper sequence. Read through completely before you start. Here goes:

After the firewall, Former F1 and top sheeting are installed and **straight**, align the engine mount to the firewall and drill all necessary holes for the mount, fuel lines, and throttle pushrod. Install blind nuts for the mount. Fuel proof the inside of the tank compartment with epoxy and install the tank. Don't add the bottom sheeting yet. Trim off the excess wood ahead of the firewall and sand the area flat. Fuel proof the firewall with epoxy, then bolt on the engine mount. (Coat the back of the mount with a light film of oil so it doesn't stick permanently.) Figure out how far your engine will extend and cut a bunch of soft balsa blocks and triangle stock to this approximate length. Bolt the engine to the mount and start gluing blocks around it (but not **to** it). Just before the engine disappears under all those blocks, rescue it and set it nearby. Now sand the bottom of the fuselage flat to accept the bottom sheeting and epoxy this on also.

When it's dry, sand the front flat to accept the plywood nose ring. Keep slipping the engine in there to check the length. It's best if you have the spinner backplate handy too, to gauge the spinner clearance. The backplate should clear the nose ring by about 1/32". When you get the clearance right, bolt in the engine, slap some glue on the nose ring, and slide the nose ring and spinner backplate onto the crank. Center the nose ring in relation to the backplate and pin it until the glue dries. Behold! All is aligned.

Finally, remove the engine and mount, fuel proof the inside of the engine compartment, and carve all those blocks down to meet the nose ring. Whew.

To align the wing and stabilizer perfectly and painlessly:

(1) Install, but do not drill, the wing hold-down blocks in the fuselage.

(2) Place the wing in the saddle. Use a length of thread to check that the wingtips are equidistant from the fuselage. Now measure from the wingtips back to the tail, again using a length of thread to ensure that both sides are equal.

(3) Once everything is kosher, tape the wing firmly to the fuselage.

(4) Drill one of the bolt holes through the wing and the hold-down blocks, using an undersize drill (so you've got something left to tap threads into). Remove the wing. Enlarge the hole in the wing to clear the hold-down bolt, and tap the hole in the hold-down block to the right thread size.

(5) Replace the wing on the fuselage, install the one bolt, and re-align as in Step 2.

(6) Repeat Steps 4 and 5 with a second bolt. Once two bolts are installed, and the wing is still aligned, you can do the last two at the same time.

(7) Bolt the wing firmly in place using all four bolts. Sand the place where the stab goes until the stab will sit exactly level relative to the wing. Pin it in place temporarily. Now, using thread again, measure from the stab tips to a point at the center of the fuselage and ahead of the stab (the wing trailing edge will do). Indicate proper alignment with pencil marks.

(8) Epoxy the stab in place, eyeballing carefully as the glue sets to make sure it stays straight. If your luck is anything like mine, the airplane will fall on the floor at this point and you can do the whole sequence again.

The use of four bolts to attach the wing, instead of two bolts and two dowels, saves an awful lot of trial fitting, gluing, and swearing. In addition, it permits fine adjustment in getting the wing exactly level on the fuselage.

Okay, you get one more handy hint. If you do put MonoKote on this beast, which I recommend, you may become bewildered by the hinge gaps. There's no problem if you simply pre-cover the edges of the surfaces with 1/4" strips of material, before gluing in the hinges. Not only does this eliminate a lot of hassle, but it also makes it that much easier to pin your hinges. After the hinges have been tack glued in, just drill a 1/16" hole through each side of each hinge, stuff in a round toothpick, and Zap it in place. Trim the ends with a nail clipper or small saw blade, then sand flush. After covering, there's no way to tell that they are there except by the smile of well-being and security on your face.

Flying

As the Galloping Gourmet once said, the proof of the pudding is in the tasting. The prototype Tensilon has been nothing less than scrumptious. After some initial tweaking with aileron trim and a dash of tail weight, I found myself taking it through slow rolls, point rolls and horizontal eights until the tank ran dry. This is what I had in mind at the outset, so to that extent the design is successful.

I found that it's important to have the ship trimmed with the ailerons dead neutral. If you're carrying any trim deflection at all, it will show up in the loops. The problem is not unique to this airplane, though it was quite noticeable in the prototype. I cured it by warping the wings in the required direction (see above) until the ailerons could be set at exact center. Lateral balance is another factor which affects the loops. If it doesn't loop straight, add a small amount of weight to one wingtip and see what happens.

Propellers make a difference too. The Tensilon seems to like a 9/7 better than a 10/6, which makes sense because of its low-drag design. With the 9/7 it will get "on the step" and stay there after only a slight dive. Watching it come out of a big Split-S is a beautiful sight reminiscent of certain scenes from "Twelve O'Clock High." Who needs pipes? Hee hee. I might add that the prop is probably the second most important aerodynamic factor affecting an airplane's performance, after the wing itself. In fact, it **is** a wing, and it is actually traveling faster than the big one behind it. Instead of buying bigger engines or pipes or hotter fuel, you might consider obtaining a pitch gauge and learning to use it. It's a better investment in the long run --- and consider the "psych" value of showing up at the contests with all the stations marked on your prop blades.

To me, an airplane should be small enough to go fast, straight enough to do perfect maneuvers, simple enough to hang together flight after flight, and pretty enough to make the rest worthwhile. Above all, it should present a minimum of hassle to interfere with your flying pleasure. The Tensilon has been all this to me, and I sincerly hope you enjoy it as much and I have. □

From RCModeler July 1979