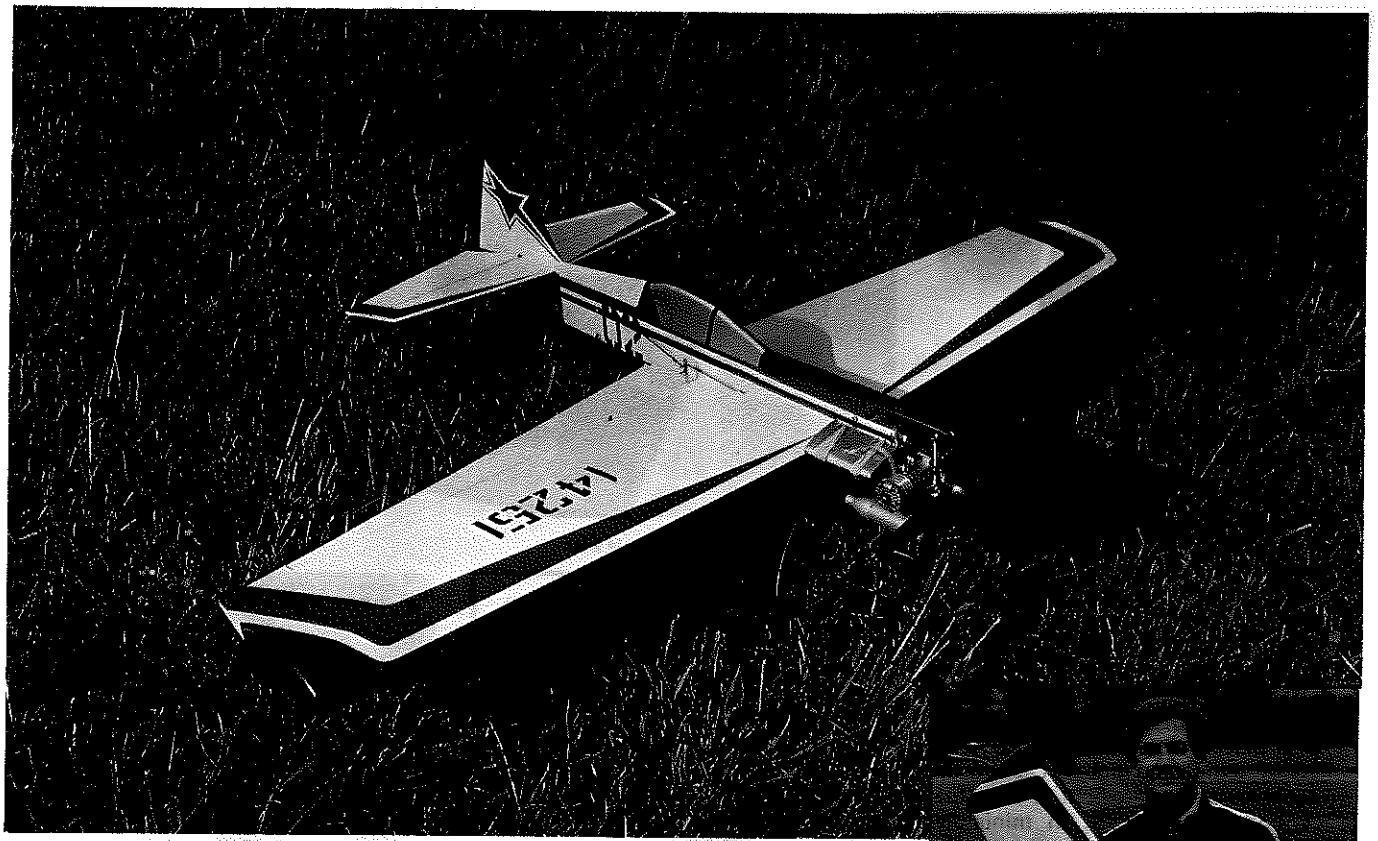
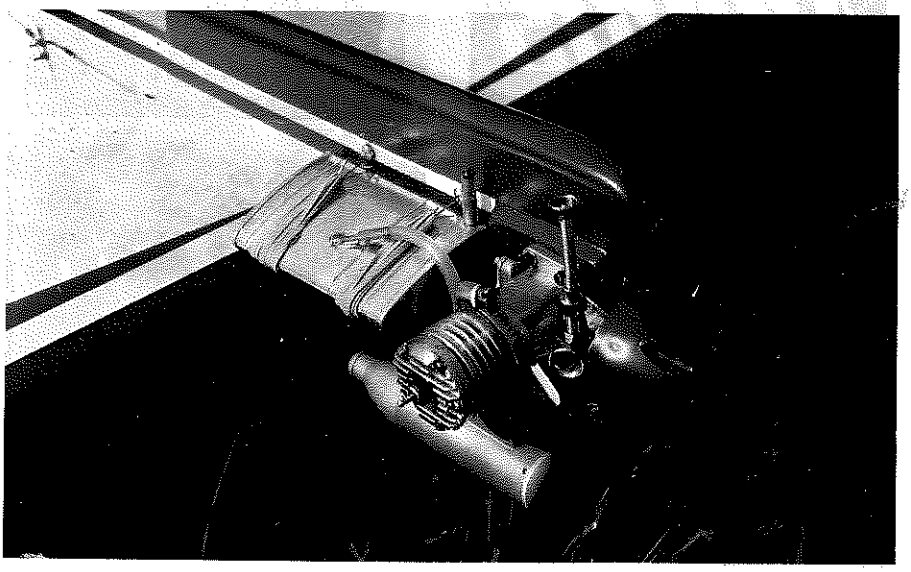


SUKHOI SU-26

By RICHARD SCHNEIDER. . .Here's an interesting profile control line model that has taken two firsts in competition. Designed for .35 power.

• The SU-26 is a Russian aerobatic airplane, one they have been using the last several years with some degree of success in competition. It uses a radial engine of about 360 horsepower, has a wingspan of about 25 feet, and I understand it uses some composite (foam and plywood) as well as more conventional construction techniques. And, as is true of most full-scale aerobatic airplanes, it looks like a big model.



Any airplane that looks like a model, and especially one that has a neat color scheme, should be made into a model. Anyway, I thought so, and since my main interest is in control line scale, why not build a stunt lookalike of the SU-26? If you don't follow that line of reasoning, let me explain: Over the last great number of years I've had the privilege of being friends with Tom Dixon, who is somewhat famous in control

Sukhoi..... *Continued from page 12*

line stunt circles. As I've mentioned before, my interests lie along scale lines, while Tom's obviously tend towards precision aerobatics. This slight diversity of interests, together with our common interests in the grand sport of control line building and flying led to a probably ill-advised challenge being issued by one of us to the other, to wit: "If you'll build a stunt airplane, I'll build a scale model." So here's my stunt model, and that's how it came about.

For those of you who are looking for the ultimate easy-to-build, high-tech stunt model from a world-famous designer/flier, you may have to look just a little bit further. This airplane is pretty basic with regards to design and construction. As far as any relationship to a world-famous designer/flier, the model design was influenced very heavily by Tom's suggestions and edicts, and it borrows liberally from some basic parameters already set down by some existing good-flying profile stunt models. (That means the moments and areas are basically those of a Twister.) Anyway, since I'm not qualified to comment intelligently on the stunt-ability of the model, I'll leave that part to Tom, assuming he'll admit to any involvement with it after all of this.

FLYING BY TOM

As Dick has written, this model arose out of a friendly bet, sort of. He's winning so far, as a new house and our rambunctious 2-1/2 year old have put a severe dent in the building schedule. But just you wait—there *will* be a Dixon scale project, and it will loop and fly inverted just like "real" airplanes. None of this wallow around the sky stuff; no sirree!

As for the subject here, it works! I flew the second-ever flight on the model and put it through the pattern despite the aged, ailing Fox on the nose. (A new piston/liner will fix that.) Total trim changes I advised were (1) move front leadout back a half inch, (2) decrease tip weight by a quarter ounce, and (3) install a pushrod brace on rear pushrod. That's it. These changes are shown on the plan.

The model is definitely a cut above the average profile. Part of this is attributable to Dick's light, straight construction. The remainder of the credit goes to his design. The wing is quite special, as it increases in airfoil thickness percentage towards the tips. This makes it easy to build on a flat board, but also greatly decreases wobbling in tight square corners. The sheeted leading edge, common on full-bore stunters but not profiles, also does its bit for airfoil efficiency. If you don't like the SU-26 fuselage, no sweat; build whatever *you* like around this wing, moments and areas and you'll have a profile that could make the top 20 at the Nats. More than anything else, the plane feels like a good Geiseke Nobler.

Don't alter the control hookup! This is part of what makes it so smooth. If you build heavy, consider a .40 engine for power. The wing can carry extra weight, but power will be needed to do it. The modified Fox .40V, O.S. and Magnum 40GP in stunt configuration would be good. The HP 40, properly reworked, is excellent too, but no longer sold in the U.S. Other good engines would be the Merco .35 and Old Series O.S. 35 stunt.

Playing with this thing has got me thinking. Let's see, if you take a Rabe Bearcat and the outlines of the SU-26, and . . . .

If anyone is still with us, let's get down to:

CONSTRUCTION

This model is pretty simple and straight forward. I did make a conscious effort to keep the weight down as best I could, given the volume of that big slab of fuselage. (I considered making a built-up profile fuselage—I've done it before—but good sense and laziness prevailed.) To this end, the model uses contest-weight balsa from Lone Star for all of the balsa parts. That stuff is really nice to work with. I recommend you also use contest-weight wood (from whatever source).

For adhesive, I stuck (no pun intended) with 30-minute epoxy and CA. I used the epoxy where a large area was involved—fuselage doublers, wing mounting, bellcrank mounting plates, etc., and CA everywhere else. Keep all the joints neat and tight and the thin CA works fine.

A good way to proceed with the construction is to make a kit; cut out all the major pieces so you'll have a collection of airplane parts in front of you all the time. This makes it apparent that there is always something ready to glue to something else, and reduces the tendency to drift away from the work bench and do something nonproductive such as watching a race on TV or raking leaves. These activities, as much fun as they are, are time-consuming and must be avoided.

The task of cutting out all of these parts need not be a chore. An inexpensive drill press (I use the kind that mounts a hand electric drill, it works fine), a Dremel (or Sears) jig saw, and a Dremel (or Sears) disc/belt sander takes all the work out of drilling accurately aligned holes and cutting and shaping plywood and large chunks of balsa. My wife has graciously presented me with these handy power tools over the years for Christmas, birthdays, etc. (She's still waiting for me to make her some doll furniture.)

The wing ribs, as always, are the most tedious cutting task. I made a 1/16-inch plywood template of the root and tip ribs, then cut enough ribs from 1/16-inch balsa for the whole wing, using the root rib template. I just rough cut these quickly, not trying to be too precise. I also had drilled two matching holes in the templates, so I could bolt the stack of rough cut ribs in the usual plywood and balsa rib sandwich. (This is making me hungry.) These holes were marked on each rough cut rib (with a fine line marking pen) and were then punched or drilled out. Next, I stacked all of these ribs between the plywood templates, bolted them together, and carved and sanded the stack to a nice tapered shape. This will be easy, since the airfoil section aft of the 1/4-inch spars, top and bottom, is constant from root to tip. Only the airfoil forward of these spars is tapered. This results in two positive aerodynamic attributes: One, the *relative* thickness of the wing increases towards the tip, and two, the *relative* high point of the airfoil moves forward, root to tip. This should make the wing stall root first, and add roll stability if the wing gets into a high lift or stall condition. I guess this is an advantage, and I don't think it can hurt. (I knew my AeroEngineering in college oh so many years ago would come in handy.) Tom thought that would make a funny-looking wing. I don't think it's so bad. Anyway, now you've got a nice stack of tapered ribs, and they would work great if you were making a wing that tapered from a wide tip on one end to a narrow tip at the other. But you're not. So separate the ribs two-by-two starting from one end of the stack or the other. (See Genesis:6 for a more thorough coverage of this two-by-two business.) Take each pair of ribs and "square-up" the tapered part to match the smaller of the two, and presto, you have two ribs of the same size, one for each side. Punch leadout holes in one of each pair and you now have matching inboard and outboard ribs.

Assembling all of the ribs and other wing parts—spars, leading and trailing edges—is next. Nothing unusual here. If you've carefully cut all the notches and things, the parts can be put together "dry," and then hit with the CA to make things permanent. The wing can be assembled in two halves, then joined with the spar joiners, or in one piece. It depends on how big a *flat* building surface you have. Mine is small, so I did it in two pieces.

The bellcrank mounting is a little different. Study the detail on the plans and you'll see it is suspended between the top and bottom 1/8-inch plywood mounts. Instead of the usual bolt or threaded rod, I used a length of 1/8-inch music wire. It is just long enough to stick through the two pieces of plywood, and is "trapped" by the 1/16-inch center section sheeting. Put spacers above and below the bellcrank to center it in the wing. I used some leftover 1/8-inch I.D. plastic bushings from a pair of Robart's Scale wheels. (See, every stunt person should build a scale model now and then so he'll have these handy pieces left over.) Be sure you put the flexible lead-outs and the pushrod on the bellcrank before you mount it permanently. The pushrod goes in the innermost hole of the three-inch bellcrank, and is 3/32-inch music wire.

Don't neglect to put shear braces between the ribs and spars. I used 3/16-inch square balsa diagonal braces; they're a bit more work than vertical grain sheeting, but they look more elegant before the wing is covered. I'm sure sheeting would work just

as well, but please put something in there.

All that's left now is to put the leading and trailing edge sheeting on, the center sheeting, and the capstrips and tips. Also, put about 3/4 of an ounce of weight in the outboard wing tip. I use old wheel weights for this. You do collect them from roadside parking lots, old wheels, etc.; don't you? They're so handy, they're marked with their weight so you don't have to guess, and once you've removed the mounting flange (whack it off with a cutoff wheel in your Moto-Tool), it can be easily shaped or flattened with a hammer and a concrete garage floor. Secure it to the wing tip with bracing and epoxy. *Don't* put the flap hinges, flaps, or flap horn on yet!

Even though I'm going to talk about the fuselage now, you don't have to wait until after the wing to do it. In fact, it's a good idea to do it before the wing for two reasons: One, the piece of wood you cut out for the wing can be used for the half-inch thick center rib when you build the wing, and two, once you've got the fuselage cut out and shaped some, it seems like the airplane's almost finished and you're home free. The fuselage is made from two pieces of 3-inch wide, 1/2-inch balsa sheet (plank?), glued edge to edge. You'll probably notice that the two sheets are not exactly straight, so you may have to try matching different edges and orientations to get a pretty good joint. There are only eight combinations—think about it. Fasten the sheets together with CA; first one side, then the other.

Before you cut this six-inch wide plank to shape, look at it a minute. Is one of the three-inch pieces harder than the other? If so, lay out the fuselage shape so that the harder piece is on the bottom. There's more load on that part.

After you've cut the fuselage to profile shape, very carefully measure and locate the wing and horizontal stabilizer holes and slots on the balsa. Take your time, be exact, and make sure everything is marked correctly. There should be *no* incidence, positive or negative, in either the wing or the stabilizer. Everything is 0-0! This is the most important step in the whole building process (along with keeping warps out of the wing), so take your time and make sure everything is correct before you *carefully* cut out the wing hole and the stabilizer slot.

Now, carve and sand the fuselage to your heart's content, tapering it front to back and top to bottom. If you're lazy, just round the edges, but it won't look near as neat. Leave the nose where the plywood doublers go flat for now. Now, very carefully lay out the locations of the hardwood motor mounts. The spacing is shown for a Fox .35. If you use some other engine, adjust the spacing if necessary. Double check everything, don't build in any up or down thrust! This isn't a free-flight, you know! When you're satisfied with your efforts, carefully cut out the fuselage to receive the motor mounts. Trial-fit everything, and when you're ready, epoxy the mounts in. Let it cure good, and in the meantime get to work on the 1/8-inch light plywood doublers. When you cut these out, notice the inboard one does not have a notch for the engine. I think profiles look neater when you do it this way. If you want to go all the way, don't put the inboard doubler on until after you've epoxied the outboard doubler on and have drilled the motor mount holes and installed the blind nuts. Then grind out little recesses in the inboard doubler to clear the blind nut flanges and epoxy the inboard doubler on. That cleans up the looks of the nose even more. Of course, if you do all that, you'll have to carefully measure and cut off the mounting bolts so they use all the threads in the nuts, but don't punch through the plywood when tightened. Also, you'll need to check them for tightness more often, it won't be as noticeable if one of them starts backing out.

One more thing. If you do all of this, you will need to also use a 1/4-inch plywood U-shaped stand off to mount the engine on, if it's a Fox. Otherwise, you'll have to cut a "Foxhole" in the inboard doubler to clear the bottom backplate mounting flange, and ruin the whole thing. Other engines may not need so much stand off.

One more more thing. You did taper the rear edges of the doubler so they fair nicely into the sides of the fuselage; didn't you? You get more points for neatness if you did.

Carve and sand all of this some more, until the edges are all rounded and nice-looking. Cut out the notch for the landing gear and drill the holes for the hold down clips. Use a drill press and some care so that you can hold the clips on with 4-40 bolts and locknuts instead of the little screws that come with them.

Don't install the gear and fill in the notch yet. You can do all that just before the paint goes on so the gear won't hang around getting in the way all the time.

Now we're really on the home stretch! I assume you've cut out and shaped the flaps, vertical and horizontal stabilizers, the rudder, and the elevators during your spare time. Go ahead and cut all the notches, slots, and holes necessary for the hinges and elevator/flap horns. Keep cutting and snipping and sliding all the parts—wing, flaps, tail feathers—together until everything fits properly. Hint: offset the flap and elevator horns so that the pushrod between the two can be removed and not installed permanently until all the paint is on. Makes things a lot easier that way. Also note: the pushrod from the bellcrank goes to the hole in the flap horn that is about one inch from the hinge centerline. The elevator pushrod goes in holes in the two horns that are the *same* distances from their respective hinge-lines. This gives *equal* angular deflection of the flaps and elevators, and the proper angular deflection relationship between the bellcrank and the flaps. All this is what Tom Dixon says to do, on any airplane, and he hasn't lied to me yet.

Now, one more final "dry" fit. Get everything all lined up square and perpendicular, and mark the positions. Take everything apart, mix up some epoxy and reassemble it according to the marks you just made. Block/clamp it up, measure the whole thing again to be sure, and leave it alone for a while. Now's the time to go rake those leaves or watch the race on TV.

COVERING AND FINISHING

There are about a thousand different ways to cover and finish a model. I'm not going to tell you how you should do it, but I'll tell you what worked for me. All of the wood parts (everything except the wing) were covered with medium weight Silkspan.Ill the slot with hard balsa or plywood. Carefully sand this smooth and touch up with filler and clear. Do the tail wheel strut now, also. I sandwiched the tail wheel strut between two pieces of 1/16-inch plywood with notches filed in them to accept the wire. This assembly was then epoxied into a matching 1/8-inch slot in the fuselage.

Now's the time to put the flaps and elevators on also. Be careful not to get epoxy into the hinges where they move.

Time for color. Spray this on if you have acill the slot with hard balsa or plywood. Carefully sand this smooth and touch up with filler and clear. Do the tail wheel strut now, also. I sandwiched the tail wheel strut between two pieces of 1/16-inch plywood with notches filed in them to accept the wire. This assembly was then epoxied into a matching 1/8-inch slot in the fuselage.

Now's the time to put the flaps and elevators on also. Be careful not to get epoxy into the hinges where they move.

Time for color. Spray this on if you have access to spray equipment. Spray cans also work. I used the color scheme used by the Russian team in the 1984 World Championships. It's attractive, but it does take a lot of time and some effort to mask it all off and such. My feelings won't be hurt if you use a simpler color scheme, such as all purple or something.

And now you've nearly got an airplane. Put an engine, fuel tank, and wheels on it, and go see if it works. I used a Fox .35, Perfect four-ounce fuel tank, and Dave Brown lightweight wheels. About those wheels—they're sure light, but the square cross-section of the tires only looks good on race cars. Chuck each wheel in your drill press and round off the corners with some 150-grit sandpaper. Much better!

FLYING

Try flying this thing on 60-foot, .015-inch stranded control lines. I hope you have a ball with it! I'm going over to Tom's house and see how his scale model is coming along.