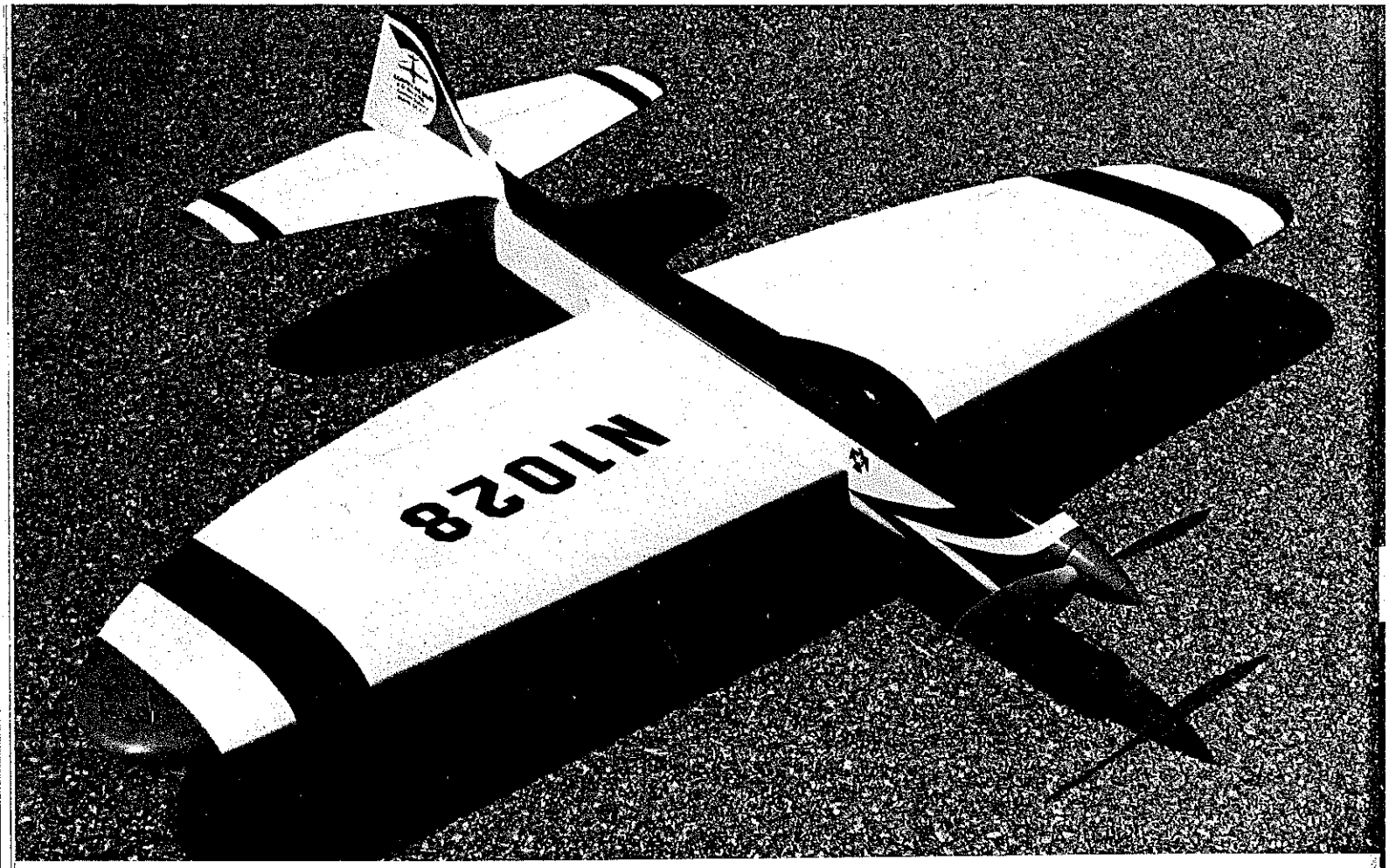


THUNDERBIRD 60

A modern-day adaptation of one of Control Line Stunt flying's earlier designs with pleasing elliptical wings produces a good looking model with a winning potential equal to its rich heritage. ■Tom Dixon

"IF YOU CAN'T BEAT 'em, join 'em!" or so the saying goes. Well, this is my "join 'em" Stunter. After many years of preference for .35-size planes, I am forced to concede that the larger, more powerful model is necessary to be competitive at the national level. Although I am not entirely convinced, even yet, that the larger model flies substantially better, I've come to admit that the image it presents is a current requirement to "play the game" with success.

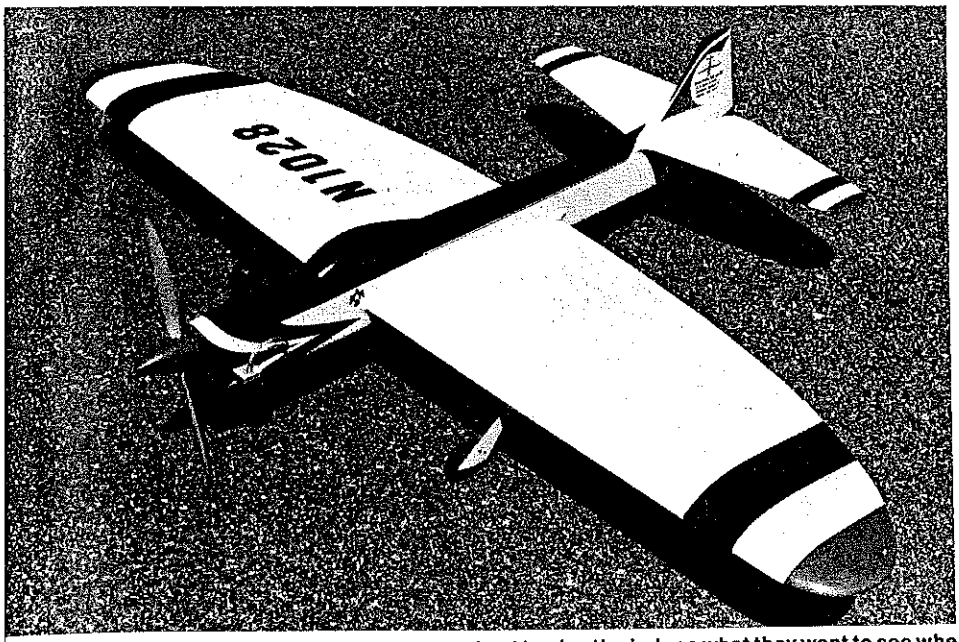
Once I'd decided to move to a larger plane, I looked around at what others were doing. The New Jersey-New York area group were all flying SuperTigre-.60-powered models of widely varying sizes ranging from Windy Urtnowski's huge Sweepers to Glen Meador's Eagle, the latter being hardly larger than the models I had been flying with Fox .35s. Here in Atlanta, Scott Bair has been flying his super-light semi-scale models with the ST .60 for two years (and now with his own homemade engines!). Frank Williams was even using the ST .60 in a Profile.

Surrounded by all that variety and with no consensus as to what might be best, I opted to simply enlarge my Phoenix—a revision of the Palmer Thunderbird—by multiplying all the linear dimensions by 110%. The airfoils and curved surfaces were enlarged by reproducing them on an enlarging photocopy machine. Along the way, too, I decided to modernize the look of the plane by straightening out the fuselage lines and using a bubble-type canopy. Also, the landing gear was moved farther out in the wing and angled inward in the current style. Wheel position was moved slightly rearward for better landings. No changes were made in the aerodynamics of the design. The result of these modifications, I hoped, would be a Thunderbird 60 capable of making a better presentation to the judges while still retaining the excellent, easy handling qualities of the smaller Phoenix from which it had emerged.

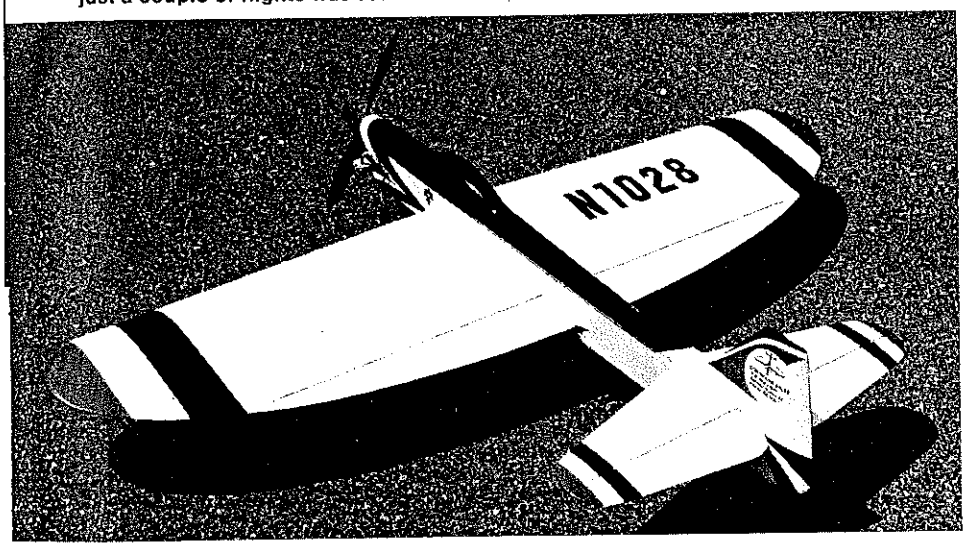
The engine, tank, and control systems for an airplane this size were brand-new ground for me. I did not like the idea of drilling a conventional spraybar hole in the crankcase of a hundred-dollar engine! Also, Scott Bair's work with true venturi, commonly referred to as "sprinkler systems," had convinced me that was a better way. The venturi were turned from ¾-in. Delrin rod to fit, retained by the spraybar in the manner of the old G-21 ST .46 Control Line engine. A major difference from the stock Tigre-type venturi is the use of only one fuel inlet hole. This was done to prevent the engine occasionally getting air bubbles into the delivery system, which can lead to erratic runs. Final venturi size is .182 in. I.D., but this may need to be varied when the plane is flown in hotter weather or at high altitude.

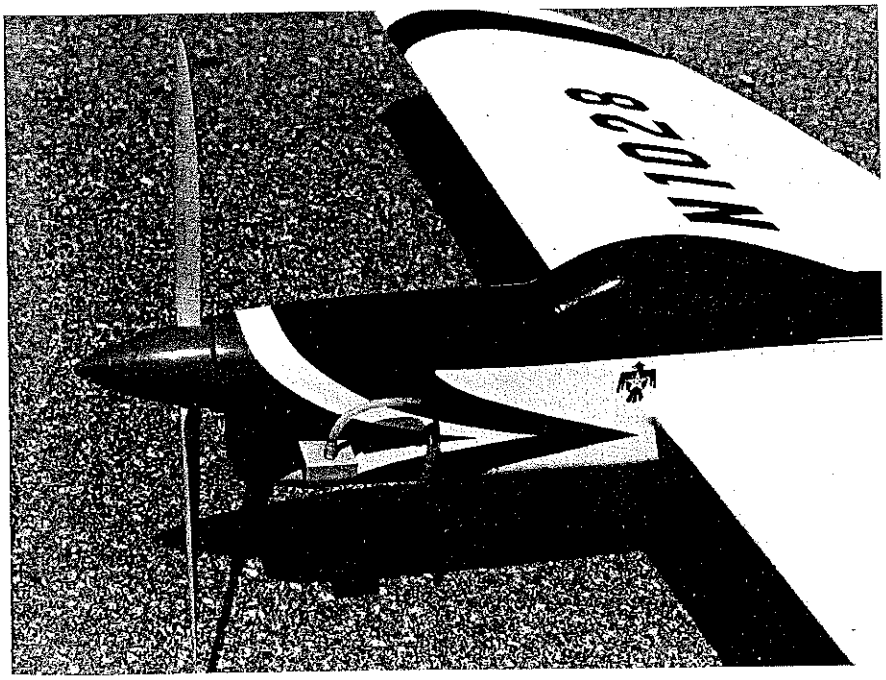
The muffler I used for the T-60 is an SST unit with only eight No. 43 size holes open. This results in a very quiet presentation without sacrificing power. In fact, at the weight and drag it is carrying the engine is so under-stressed that it remains in a constant four-cycle setting, until the four-leaf

#564



Overall Views: Our author says he started out to give the judges what they want to see when he scaled up his original Phoenix Stunter to the larger .60-size model shown here, but after just a couple of flights was sold on this stable model and its super Stunt flying qualities.





Larger diameter props (a 14 x 6 here) produce more resistance to down-maneuver speed increase, and their lower revving also results in less noise generation. Since this photo was taken our author says he's switched to a Merco .61 engine and 3- or 4-blade carbon fiber props that have the same effect as the large props but provide better ground clearance.

clover where it momentarily burps into a two-cycle. Using a large prop also keeps the noise down by decreasing rpm.

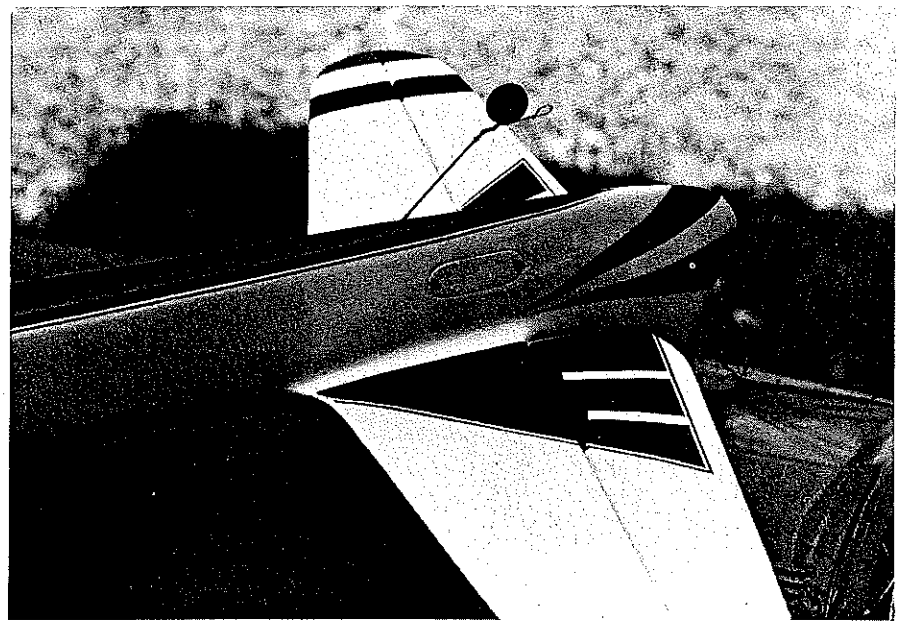
Currently, I am using a Top Flite 14-6 thinned about 50% in blade thickness. The engine is capable of turning more prop, but that would necessitate longer landing gear. It is my belief that almost all current Stunters could benefit from more prop diameter than most people use. The high static thrust from the big prop gives better vertical pull and line tension, and the large disc area prevents the model from running away going downhill. A look at full-scale aerobatic aircraft will confirm this point. All of them have huge props.

The fuel tank was designed by me and manufactured by Doug Taffinder. Thickness was chosen to align the fuel feed line with the spraybar, while the tank is resting on the motor mounts. This was basically a guess, as I had no experience with how the tank should be aligned on a .60. It turned out fine, with exactly equal upright and inverted lap times from the first flight onwards. Length and width of the tank were chosen to fit the space available in the nose. The 1¼ x 2 x 6-in. tank has a volume of between 7¼ and 7½ oz., more than adequate for AMA Pattern time limits. Actually, I measure fuel into the tank, and am using only 6¼ oz. Doug Taffinder has these tanks available on a special-order basis, and has dubbed them the Dixie 60. Write to him for details. (Carolina-Taffinder, 8345 Delhi Rd., North Charleston, SC 29418. Phone: 803/553-7169.) They are not cheap, because each is handmade; but they are beautifully done, and well worth it.

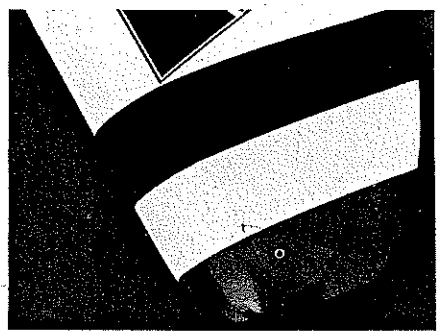
One more advantage of the Dixie 60 tank is that its mounting is canted outwards at the rear. This ensures solid fuel feed throughout the flight until the uniflow vent uncovers just before fuel is gone. A straight mounting can result in occasional air bubbles toward the end of the run. It can also result in unused fuel with the attendant weight and CG change problems.

Line length was begun at 69½ ft. from the center of the handle—the maximum allowable length by AMA and FAI rules. No change has been found necessary. With these lines (.018 cable) and the 14-6 prop, a ground rpm setting of 7,300 gives a fairly slow 5.5 to 5.6 seconds per lap and solid tension in all maneuvers. In very windy conditions, the prop can be changed to a 14-5 and run at 7,800 rpm, which gives a slightly more constant speed and defense against windup—but only at the expense of a higher noise level and the necessity of adjusting the fuel volume to maintain the length of the run. I generally stay with the 14-6.

The control system uses a conventional Top Flite three-inch nylon bellcrank and X-cell 3/32 wire horns. After experimenting with making some ⅛-in. wire horns, I felt these were just not necessary. Instead, the X-cell horn wires were cut off and re-bent as short as practical to increase their torsion resistance. I do not recommend using a flap horn length much over 3½ in., or

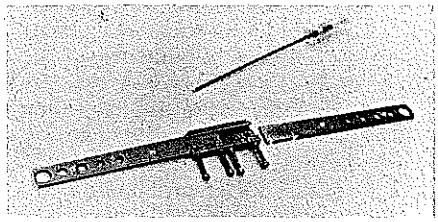


The hatch in the rear was included so additional tail weight could be added to get the proper CG. However, after machining away part of the cylinder head, no tail weight was needed.

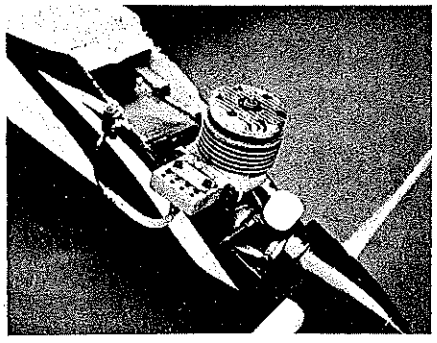


Small hatch on the outboard wing tip bottom makes it easy to vary the tip weight necessary to trim the model. A non-symmetrical wing could have been used, but building one semi-eliptical wing panel longer than the other is difficult; it also would look odd.

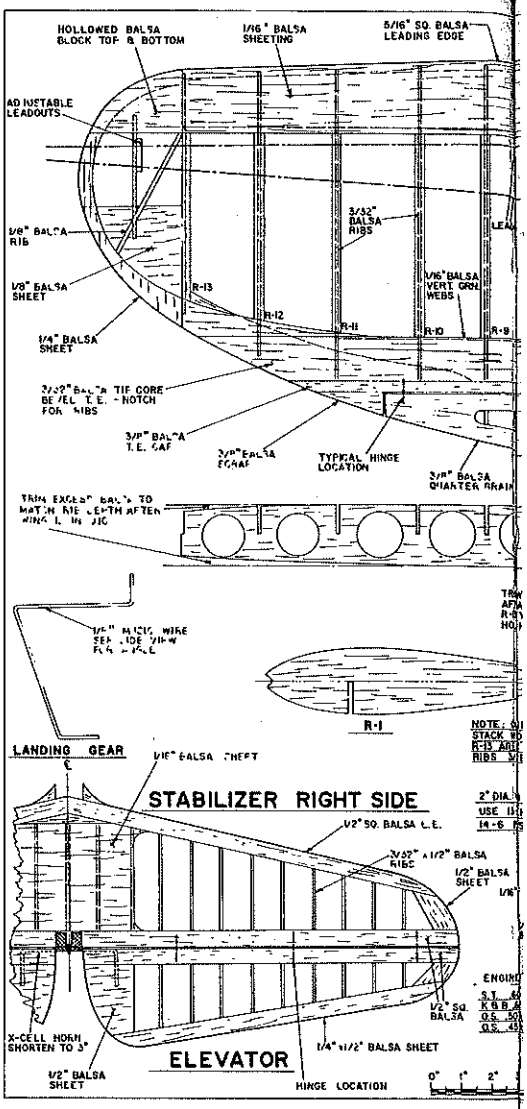
Becky Dixon shows off the Thunderbird-inspired paint scheme and wide-stance landing gear on husband Tom's big Stunter.



Using a modified Byron's plug-in wing joiner allows this large-span model to fit into the smallest of compact cars—also simplifies construction of the wing and maintenance.



Only eight holes in the muffler help to keep things quiet. Note the machined cylinder head and modification of the stock venturi on the SuperTigre (text has more details).



elevator horn length over 2½ in., on a model this size unless the horn wires are from ⅛-in. material.

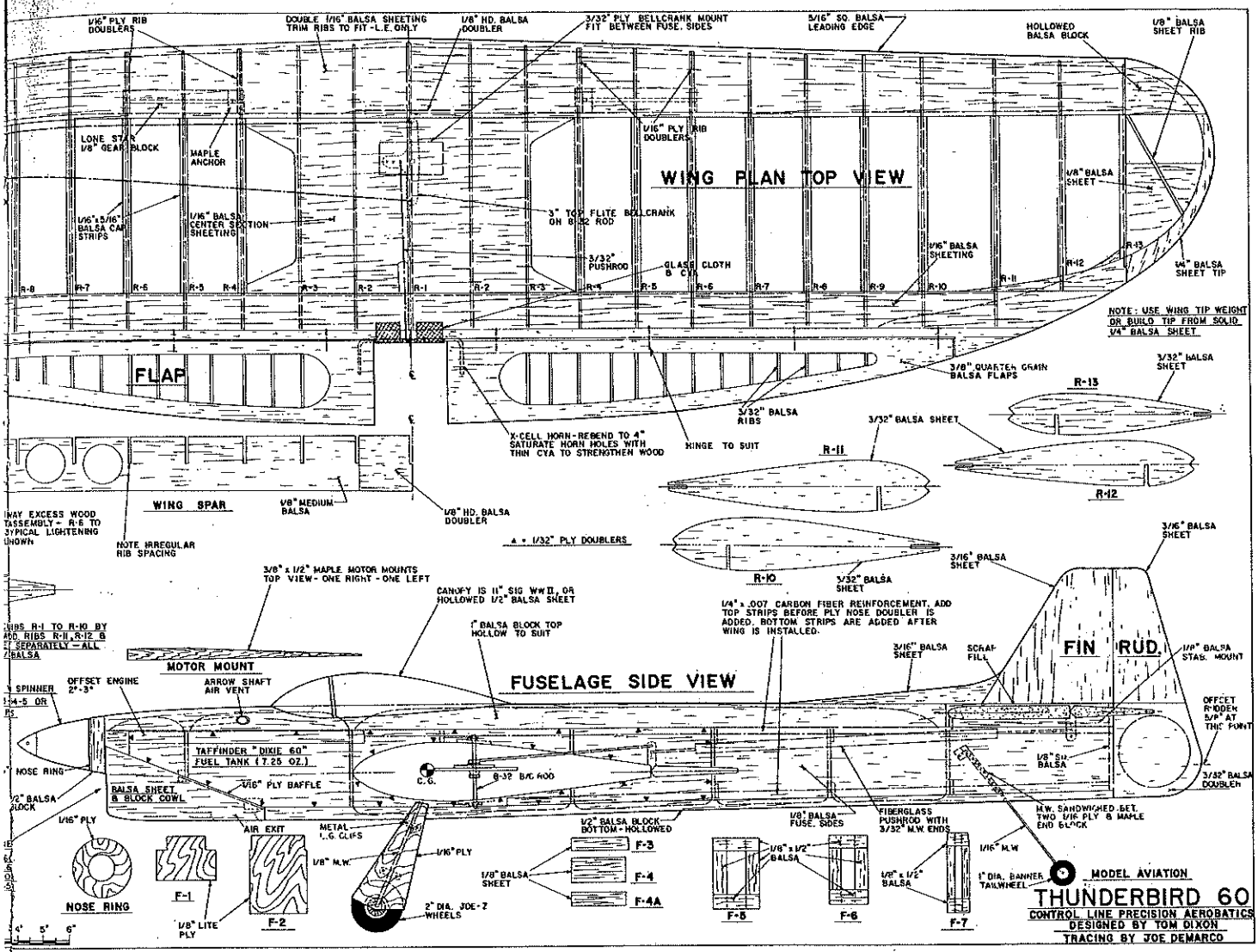
The bellcrank is mounted *backwards*, but not for the effect on precession, P-Factor, or anything else currently controversial. Rather, it is done as a practical matter: to keep the pushrod to the flaps as straight as possible, to clear the center ribs, and to keep all wire bends toward the outside of the circle in order to reduce the load on the retaining washers.

A major departure for me in adapting the Thunderbird was to take a cue from Stan Powell and reduce the sensitivity of the control system. The closest inside hole of the bellcrank is used to drive the flap pushrod. The receiving hole in the flap horn is one inch from the hinge line of the flaps. This results in a very smooth system that allows small inputs without jerkiness. When using a four-inch spacing handle and with reflexes similar to mine, it is almost impossible to bounce a corner by over-controlling the model. If you like quicker responses, a larger handle can always be used.

Lead-outs receive special attention because of the anticipated increase in flight loads. Brass-plated .027-in. cable, from the Perfect Co., is inserted into soft brass tubing (1/32 I.D.) which is bent into a teardrop shape at bellcrank and at the line attachment point. The tubing allows a smooth bearing surface at the bellcrank and spreads the load on the cable. It also looks "Pro Stunt." (Note: Sullivan C-D lead-out cable is too large to fit in the 1/32 I.D. tubing.)

While discussing controls, it seems timely to talk some about trimming Stunters. One thing you will notice if you build the T-60 is that because of its equal-panel wings a lot of tip weight is necessary. I have not weighed the total ballast in mine, but I'd guess it to be close to three ounces. (Under FAI rules lighter lines may be used, in which case tip weight could be less.) I find that tip weight gives more effective line tension than nonequal wings. Besides, a semi-elliptical wing looks odd, and is difficult to build with one panel longer than the other.

The T-60 tends to build nose-heavy. In anticipation of this problem, I machined excess weight off a spare cylinder head. I also built in a hatch to add tail weight. As it turned out, no tail weight was needed, but the ⅞-oz. lighter machined head was neces-



sary to balance the plane. This is the only model I have built in 20 years that did not have some tail weight—or, more usually, nose weight—to bring it into trim. I might mention, too, that during construction the spinner, backplate, and prop nut were also machined down to reduce nose heaviness. The lightness of its extremities is a major factor in the plane's ability to "groove." Even with proper CG a Stunter with heavy tail and heavy nose is both harder to turn and harder to stop turning, due to the mass operating on a long moment arm.

Too-heavy wing tips produces the same effect in the roll axis: Minor gusts make the airplane bounce more. A major advantage of elliptical-type wings like those in the T-60 is that the tips build up light because there is much less wood at the extremities. Think about it next time you consider building a foam wing with block tips.

It is extremely helpful, if you are a novice, to have a more expert flier help you trim your plane. The expert can more quickly figure out where lead-outs need to be placed, where trim weight may be needed, and whether flaps and elevators need to be "tweaked" to dial the model in. Here in Atlanta, we find that flying one another's ships brings twofold benefits. One flier gets another's opinion as to what is needed, and the observer viewing the plane from outside the circle can see things the pilot cannot view well, such as flying with one wing slightly high or low. I believe that it is well worth traveling even several hundred miles to get together with someone who can help you trim a new plane, rather than to struggle alone. The companionship is worth it, too.

Flying Hand-Launched Gliders, incidentally, has a big payoff in helping to develop a feel for trim in general. Nothing else I know of can teach you as much for the price or time involved. Although not all you learn by way of HLG is directly applicable to Control Line, you just may develop another good hobby and get some exercise while you're at it. Free Flighters are pretty good people, too!

Construction. Only the unusual aspects of construction will be highlighted here, as the basic sequences are the same as in my "Phoenix" and "Smoother" articles (*MA*, Feb. 1984 and March 1985, respectively). It is also assumed that this is not the builder's first scratch-built model. I certainly don't recommend it as such.

Wing. Please note the double leading edge planking at the center ribs. This is added as a precaution against rough handling, pull-testing, and, to a lesser degree, possible folding of the wing. Remember to trim the ribs accordingly before assembling the internal wing structure, as it is difficult to do accurately once in the jig. (How did I learn that?) The rear center section can be doubled, too, if you have any doubts about the wing's integrity. Mine has held up fine in 25-mph winds without the doubled rear planking, but I have heard of a T-60 built from my early plans in which the wing folded. Since I have not talked to the builder, however, I do not know if he hollowed things better left solid or deviated from the plans in some other way that might explain the buckling.

Also note the webbing at the trailing edge. This is essential if MonoKote or tissue covering is used. It prevents the flaps from inducing a twist in the wing in reaction to the flaps being deflected. Grain direction should be vertical in the webbing, and the fits should be tight but not forced.

Spar material should not be super-light 4-lb. balsa. Medium-weight wood is better here. Trailing edge sheeting should be quarter-grain, or speckled-appearing, wood —both for stiffness and resistance against over-thinning when shaping the trailing edge cap. *Continued on page 150*

return them) are welcomed as valuable contributions to future articles. Please contact me directly: James J. Noonan, 7454 West Thurston Circle, Milwaukee, WI 53218.

T-60/Dixon

Continued from page 69

Weight can be readily saved by hollowing out the spar to within about ¼ in. of ribs, and sheeting after the wing is fully constructed. Do not hollow inboard of the landing gear locations. Ribs should also be hollowed, but leave a "bar" vertically about halfway between spar and trailing edge to guard against the covering shrinkage flattening the airfoil curvature. Lightening holes should also be cut in the nose sections of the ribs before sheeting. I grind away the back of the leading edge strip using a Robart sanding drum and Dremel tool, so that only a triangle shape is left between the ribs.

Fuselage. Note the .007-in. carbon fiber strip reinforcing shown on the plans. This greatly augments the fuselage's resistance to bending under air loads while adding almost no weight. It is also very important to accurately shape the wing cutouts and to perform the wing-to-fuselage assembly with the parts inverted on a flat surface, so as to avoid bending the fuselage crutch out of alignment during assembly. The top of the crutch must remain in a straight line after the wing is installed to avoid building in unwanted incidence.

The tail wheel mount is a much easier and stronger method than the traditional copper wire lacing. Simply place oversized 1/16 ply mount blanks in a vise and drill between them with 1/16 drill to make a groove for the wire. Sandwich the tail gear wire between the two ply pieces, using thick CyA glue to join. Add a maple anchor for the protruding end of the wire so as to resist twisting. Then trim the whole assembly to fit the rear of the fuselage. It takes longer to describe than to do.

Moving to the other end, take pains to keep the cowl very light. Hollow it out as much as possible. I coat the inside of the nose and cowl with Hobby Poxy Formula 2 glue for strength and fuel resistance. This is heated after application with a heat gun and the excess merely poured out. The heat thins the glue so that it soaks in, accelerating the cure-time. Covering the outside of the cowl with silkspan helps in finishing and adds some strength. Some people advocate covering the nose with glass cloth, but I have not found this necessary.

The canopy shown on the plans is built up from sheet balsa. The original model used a cut-down Sig 11-in. WW II canopy, but this softened and distorted slightly during painting. As a result, future models will have a wood, or possibly a fiberglass, canopy. Ex-Atlantan Lou Melancon avoided this whole problem on his T-60 by simulating the canopy on the nose section, much like that on Stan Powell's Dove. Lou's plane is finished with MonoKote and came out 4 oz. lighter than mine, at 53 oz.! He also used Sig Chipmunk wheel pants for a distinctive touch.

Finishing. The choice of finishing is at the discretion of the builder. My model is covered with Sig Light Flite Plyspan tissue and finished with Sig nitrate, then butyrate and Lite Coat dope. This is rubbed out using progressively finer grades of steel wool, then polished with Dupont white compound, and waxed. As mentioned, Lou Melancon MonoKoted his plane with excellent results. The tip shape prevents many of the usual problems of covering wing tips with MonoKote. Take your choice. With business and family pressures, I am leaning more and more towards the iron-on coverings for the timesaving advantages.

Further developments. The next generation of T-60s will have a two-piece plug-in wing and removable tail surfaces. My twin enthusiasms for large planes and small automobiles are forcing this move; but another great advantage is the ease of finishing and maintenance of individual components. Easier storage and shipping to distant contest sites are also pluses. The Europeans have been building this way for years. How to do it? Well, a hint is to adapt the plug-in system that Byron Originals

Continued on page 152

uses on its quarter-scale RC models. Since my plug-in system is not yet built and flying, details are not included here; but if you would like more information about the work-in-progress, I can be contacted at: Suite 401, 1938 Peachtree Rd., Atlanta, GA 30309. Likewise, if you have questions or comments on the model presented here, feel free to write.

How did all these design and building considerations work out? In its first competition outing the T-60 won the 31st King Orange Stunt event and the Al Lewis Flyoff Trophy. I had spent the morning judging Old-Timer Stunt, and my first official flight was my second total flight of the day and the first in several hours. This, I believe, is testimony to the easy handling and accurate flying characteristics the design possesses. How the T-60 and I do at other important events remains to be seen. One thing is sure, though: I'm glad I joined 'em. I'm glad I let my Phoenix live a new life as a larger bird!

CI Aerobatics/Fancher

Continued from page 70

hinge is almost mandatory since they can be installed (and in fact should be) *after* the model is covered. Let's make that perfectly clear. *The surfaces to be hinged should be slotted to accept the hinges prior to covering.* Apply the covering next and seal right over the hinge slots. The slots are then reopened with a sharp razor knife, and only then should the hinges be installed.

When installing the bellcrank two things are very important. First, be sure that the installation is perfectly sound. The platform must be rigidly supported and properly glued, using either epoxy or aliphatic-resin glue.

The bellcrank bolt should be firmly tightened and the nut installed with epoxy to prevent loosening. Do not solder washers on the nylon-type bellcranks as pushrod retainers. The heat may melt the nylon and disrupt smooth control action. I use 3/32-in. Du-Bro wheel collars with the setscrews firmly tightened and epoxied in place.

Second, be sure that the flap end of the pushrod is directly in line with, and one inch above, the flap hinge line with the bellcrank in neutral. This will allow proper alignment with the flap horn and thus ensure that the whole control system will be in neutral simultaneously.

When shaping the sheet balsa flaps and tail surfaces, use the rounded cross section as shown on the plans. *Don't try to taper them, as they are too thin and will be unacceptably weakened.*

Now is the time to cut the slots for your hinges. Don't attempt to get a narrow gap between the hinged surfaces. If you do, what usually happens is that the controls end up rubbing, depriving you of both freedom and range of control movement. Just leave the natural gap which results from the rounded, pinned section of the hinge.

Shaping a profile fuselage is a pain in the neck. The plywood doublers don't take well to carving or planing, and sanding them to shape seems an imposing task. Try it this way.

Assemble the balsa profile fuselage, hardwood engine mounts, plywood doublers, and the inboard, ¼-in. (or thicker) balsa "tripler" we discussed last month. Blend the square rear edge of the ply doubler into the balsa fuse using a piece of scrap ⅛-in. balsa already sanded to triangular section.

Now comes the tough part: shaping the front end. Believe it or not, we're going to sand that sucker to shape!

First, clamp the fuse to your work bench so that the nose sticks out into midair. Use either a large C-clamp with some scrap hardwood to protect the balsa fuse, or pile on all your old *Model Aviation* mags. To protect against snapping the fuse in half as we shape it, place a piece of scrap hardwood under the fuse to support the nose. A piece of one-by-two about three feet long is good.

Now, using a 2 x 12-in. strip of coarse, 40-grit sandpaper, attack each side of the nose as though you were buffing a pair of shoes. As you use your buffing motion, move fore and aft so that you are removing material uniformly. You'll be surprised at how fast you can shape the front end, plywood and all.

Now that the hard part is done, carve the aft fuse to a pleasant shape using a razor plane and sandpaper. Don't overly taper it toward the tail, as doing so will weaken this area and allow the tail to flex in flight. Prior to final shaping of this area, I permanently attach the rudder so that it has a good solid joint and the fuselage can be faired smoothly into it.

Although my previous use of iron-on coverings had been limited to Top Flite's MonoKote, I chose to try Sig's new Supercoat material. I was very pleased with its performance. It is activated at a much lower temperature and is somewhat

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